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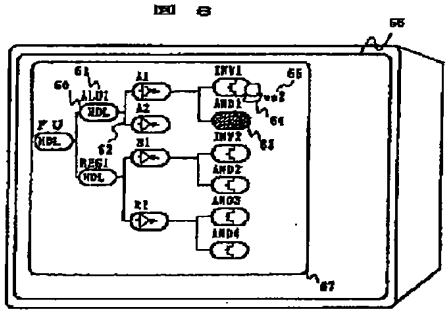
(54)【発明の名称】　分散設計支援方法およびシステム

(57)【要約】

【構成】設計対象を複数の階層に分け、複数の設計者がネットワークにより相互に接続された端末装置を用いて階層の各構成要素を並行して設計する分散設計支援方法において、各構成要素の設計進行状況を管理し、その設計進行状況を各設計者の使用している端末装置の表示画面上に表示する。

【効果】設計データの現在の進行状況が図形として表示されるため、データベースに問い合わせることなく、どの設計データがどの様な設計進行状況にあるかが容易に掌握できる。また、設計データのシミュレーションでの使用の為の操作が、設計進行状況の表示を使用して行えるので、指示誤りを少なくすることができる。



甲第９号証

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【特許請求の範囲】

【請求項１】設計対象を複数の階層に分け、複数の設計者がネットワークにより相互に接続された端末装置を用いて階層の各構成要素を並行して設計する分散設計支援方法において、

各構成要素の設計進行状況を管理し、その設計進行状況を各設計者の使用している端末装置の表示画面上に表示することを特徴とする分散設計支援方法。

【請求項２】前記各構成要素を、その構成要素の工程種別毎に異なる図形で、階層的に表示することを特徴とする請求項１記載の分散設計支援方法。

【請求項３】設計が未完成である構成要素の図形を、設計が完成している構成要素の図形と区別して表示することを特徴とする請求項２記載の分散設計支援方法。

【請求項４】現在編集中である構成要素の図形に付随して、現在編集中の端末装置の存在を示す図形を表示することを特徴とする請求項２記載の分散設計支援方法。

【請求項５】前記表示画面上に表示された構成要素を指示することにより、その構成要素の設計データを前記ネットワークを介して取り寄せることを特徴とする請求項１記載の分散設計支援方法。

【請求項６】ある端末装置における任意の構成要素の編集開始／終了時に、他の端末装置がその構成要素の設計データを参照中である場合、前記ある端末装置から前記他の端末装置にその旨の通知を発することを特徴とする請求項１記載の分散設計支援方法。

【請求項７】ある端末装置における任意の構成要素の編集開始／終了時に、他の端末装置がその構成要素の設計データを参照中である場合、前記ある端末装置から前記他の端末装置にその旨の通知を発し、当該他の端末装置の表示画面上で前記ある端末装置が編集している構成要素の図形に付随して、当該通知があったことを示す図形を表示することを特徴とする請求項２記載の分散設計支援方法。

【請求項８】前記通知があったことを示す図形を指示することにより、通知内容を表示するウィンドウを開くことを特徴とする請求項７記載の分散設計支援方法。

【請求項９】任意の端末装置において前記設計対象の動作のシミュレーションを実行する際、前記複数の階層のいずれの構成要素の設計データを利用するかを、前記表示画面上の構成要素の図形を指示することにより指定し、該指定された図形の表示属性を変化させ、指定された構成要素の設計データをネットワークを介して取り寄せることを特徴とする請求項２記載の分散設計支援方法。

【請求項１０】設計対象を複数の階層に分け、複数の設計者がネットワークにより相互に接続された端末装置を用いて階層の各構成要素を並行して設計する分散設計支援システムにおいて、

設計データを格納する設計データベースを管理するとともに、複数の設計者による前記各構成要素の設計進行状況を管理する少なくとも１台の管理用端末装置と、

複数の設計者が設計に使用する複数の設計用端末装置とを備え、

前記管理用端末装置は、前記各構成要素の階層接続関係および前記設計データベース内の設計データと各構成要素との対応関係を管理する設計データ管理テーブルと、各構成要素の設計データの設計進行状況を管理する進行状況管理テーブルと、前記設計用端末装置との間での設計データの授受の際に前記進行状況管理テーブルを更新する手段とを有し、

前記設計用端末装置は、前記進行状況管理テーブルの内容に従って前記各構成要素の設計進行状況を表示画面上に表示する手段と、前記進行状況管理テーブルの内容の設定・更新情報を入力する手段とを有することを特徴とする分散設計支援システム。

【請求項１１】前記進行状況管理テーブルは、前記各構成要素毎に、その工程種別および進行状況コードを保有することを特徴とする請求項１０記載の分散設計支援システム。

【請求項１２】前記進行状況管理テーブルは、前記各構成要素毎に、当該構成要素の設計データを編集中の端末装置名、および当該構成要素の設計データを参照中の端末装置名の少なくとも一方をさらに保有することを特徴とする分散設計支援システム。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、計算機との対話によりＶＬＳＩ論理図・回路図・マスクパターンを複数の設計者が分散並行設計する際の図面情報の管理、及び管理の為の表示方式に関する。

【０００２】

【従来の技術】ＶＬＳＩの設計においては、その回路規模が数百万トランジスタと大きいため階層設計が行われている。そのため、それらの設計を支援するＣＡＤシステムにおいても、設計データの階層管理や、複数の設計者による設計データの共用管理が行われる。

【０００３】例えば、特開平－３１０４７３号公報に記載のように、図面データのディレクトリ情報の中に各図面間の親子関係を含ませることにより、図面間の関係を管理したり、特開平２－４８７７４号公報に記載のように、設計データに修正可不可フラグ、修正者名、修正時刻、修正完了時刻を示す修正情報を付加して、複数の設計者が同一設計データを重複して修正しないようにすることが行われている。

【０００４】

【発明が解決しようとする課題】上述の管理方式においては、設計図面がどの様な階層構造を持つかを設計者が知ることができるが、検索のための入力を必要とする。例えば、ある図面Ａの下位階層の図面はどのようなもの

があるかは、図面名Ａをキーとしてｃａｄシステムに検索させる必要がある。また、他の設計者がある図面を編集中かどうかは、ＣＡＤプログラムが管理しているため、その図面をＣＡＤシステムにより使用しようとするまで分からない。さらに、設計図面が完全に設計完了しているかについての管理は、設計者が行っていた。このため、他の設計者の設計データと組み合わせてシミュレーションをおこなう場合、階層データのどのレベルのどのバージョンのデータを組み合わせて使うかを設計者が管理しなければならず、管理が煩雑であり、間違いが起こり易かった。

【０００５】例えば、シミュレーションでは、図３に示すような階層を持つ設計データに対して、必要とする階層レベルを使用してシミュレーションが行われる。図３において、図面３０は、演算ユニットＦＵの最上位図面であり、構成要素ＡＬＵ１，ＲＥＧ１は機能記述により記述されている。図面３１は、図面３０の構成要素ＡＬＵ１の下位階層の図面であり、構成要素Ａ１，Ａ２が機能記述により記述されている。図面３２は、図面３１の構成要素Ａ１の下位階層図面の論理図であり、ＡＮＤ１，ＩＮＶ１の論理シンボルにより構成されている。図面３３は、図面３２のＩＮＶ１の下位階層図面の回路図であり、ＭＯＳトランジスタＭＯＳ１，ＭＯＳ２から構成されている。図３では省略されているが、構成要素ＲＥＧ１についても構成要素ＡＬＵ１と同様な階層構造を持っており、具体的には図２に示すような階層構造を持つ。

【０００６】ここで、図面３０の演算ユニットＦＵについてシュミレーションを行う場合に、例えば、図面３０の構成要素ＲＥＧ１については機能記述を用い、構成要素ＡＬＵ１については、図面３１の構成要素Ａ２を機能記述として用いる。図面３１の構成要素Ａ１については、さらに下位階層の図面３２のＡＮＤ１を論理レベルとして用いたものと、ＩＮＶ１をさらに下位階層の図面３３の回路レベルとして用いたもので置き換える。このように、利用可能な下位階層の図面部分を利用してシミュレーションを実行するということが行われる。各データにより異なる階層の図面を利用するのは、回路レベルのような詳細なレベルでシミュレーションを行えば、シミュレーションの精度は向上するが計算時間が長くかかるということ、また、複数の設計者の設計進度は一様でなく、ある階層の設計データが全て揃っているとは限らないということ、等のためであり、各データについて一番有効なシミュレーションレベルを採用しようとするからである。

【０００７】しかし、従来はシミュレーションに使用できるレベルの設計データはどれであるかの管理を設計者が行う必要があった為、データの指示を間違い易く、最新の設計状態への対応が遅れるという問題があった。

【０００８】本発明の目的は、分散設計時の設計の進行状況の掌握を容易にし、各設計者が必要とする情報を即時に容易に得られる分散設計支援方法およびシステムを提供することにある。

【０００９】

【課題を解決するための手段】上記目的を達成するために、本発明による分散設計支援方法は、設計対象を複数の階層に分け、複数の設計者がネットワークにより相互に接続された端末装置を用いて階層の各構成要素を並行して設計する分散設計支援方法において、各構成要素の設計進行状況を管理し、その設計進行状況を各設計者の使用している端末装置の表示画面上に表示するようにしたものである。

【００１０】好ましくは、前記各構成要素を、その構成要素の工程種別毎に異なる図形で、階層的に表示する。その際、設計が未完成である構成要素の図形を、設計が完成している構成要素の図形と区別して表示する。また、現在編集中である構成要素の図形に付随して、現在編集中の端末装置の存在を示す図形を表示する。

【００１１】また、前記表示画面上に表示された構成要素を指示することにより、その構成要素の設計データを前記ネットワークを介して取り寄せられるようにする。

【００１２】本発明による分散設計支援システムは、設計対象を複数の階層に分け、複数の設計者がネットワークにより相互に接続された端末装置を用いて階層の各構成要素を並行して設計する分散設計支援システムにおいて、設計データを格納する設計データベースを管理するとともに、複数の設計者による前記各構成要素の設計進行状況を管理する少なくとも１台の管理用端末装置と、複数の設計者が設計に使用する複数の設計用端末装置とを備え、前記管理用端末装置は、前記各構成要素の階層接続関係および前記設計データベース内の設計データと各構成要素との対応関係を管理する設計データ管理テーブルと、各構成要素の設計データの設計進行状況を管理する進行状況管理テーブルと、前記設計用端末装置との間での設計データの授受の際に前記進行状況管理テーブルを更新する手段とを有し、前記設計用端末装置は、前記進行状況管理テーブルの内容に従って前記各構成要素の設計進行状況を表示画面上に表示する手段と、前記進行状況管理テーブルの内容の設定・更新情報を入力する手段とを有することを特徴とするものである。

【００１３】好ましくは、前記進行状況管理テーブルは、前記各構成要素毎に、その工程種別および進行状況コードを保有する。

【００１４】また、前記進行状況管理テーブルは、前記各構成要素毎に、当該構成要素の設計データを編集中の端末装置名、および当該構成要素の設計データを参照中の端末装置名の少なくとも一方をさらに保有する。

【００１５】

【作用】各設計者が設計している各設計データの進行状況が各設計者の使用している端末装置の表示画面上に表

示されるため、データベースに問い合わせることなく、各設計データの設計進行状況の掌握が容易に行える。また、表示された各設計データの進行状況を指示することにより、その進行状況の設計データを取り寄せて使用することが出来るため、必要とする設計データが容易に得られる。さらに、設計データのシミュレーションでの使用の為の操作が、設計進行状況の表示を使用して行えるので、指示誤りを少なくすることができる。

【００１６】

【実施例】以下、図面に従い本発明の実施例を説明する。

【００１７】図１は、本実施例ＣＡＤシステムの構成を示したものである。同図において、１０は管理用ワークステーション（ＷＳ）、１１は設計データベースファイル、１２は設計進行状況管理テーブル、１３、１４は設計用ワークステーション、１５は各ワークステーションを相互に接続するネットワークである。ここでは、設計用ワークステーション１３，１４を便宜上２台のみ示しているが３台以上接続することもできる。ワークステーション１０，１３，１４の各々は、当該ワークステーション上でＣＡＤプログラム（例えば、論理図編集エディタ、回路図編集エディタ等）を実行する。その際、各ワークステーションにて作成された論理図面等の設計データは、ネットワーク１５を介して管理用ワークステーション１０により設計データベースファイル１１に格納管理される。勿論、ワークステーション１０では編集を行わず管理のみを行うようなシステムであってもよい。また、設計データベースファイル１１と設計進行状況管理テーブル１２とは別々の記憶装置に格納されるように図示したが、同一の記憶装置内に格納されるようにしてもよい。

【００１８】本システムでは、設計進行状況管理テーブル１２に各設計データの設計進行状況を管理し、その管理データをワークステーション１０，１３，１４の表示画面上に設計進行状況１６，１７，１８として表示することにより、各設計者が全体の設計進行状況を掌握することを容易とする。

【００１９】図２は、本ＣＡＤシステムで設計される設計データの階層構造の例を示す。

【００２０】同図は、ＦＵという実数演算ユニットの階層構造を表したものであり、前述した図３の各階層図面の例に対応している。図２から分かるように、演算ユニットＦＵは、機能記述レベルで記述された図面ＡＬＵ１および図面ＲＥＧ１から構成される。ＡＬＵ１は、論理記述レベルで記述された図面Ａ１および図面Ａ２から構成される。同様にＲＥＧ１は論理記述レベルの図面Ｒ１，図面Ｒ２から構成されている。さらに、Ａ１は、回路記述レベル記述された図面ＩＮＶ１および図面ＡＮＤ１から構成される。同様にＲ１は、回路記述レベルの図面ＩＮＶ２および図面ＡＮＤ２から構成され、Ｒ２は、

回路記述レベルの図面ＡＮＤ３および図面ＡＮＤ４から構成されている。

【００２１】これらの各構成要素の設計データは、例えば図４に示すような管理テーブル４６により設計データベース１１として管理される。管理テーブル４６においては各設計データに対応して、上位階層データへのポインタ４１と下位階層へのポインタ４２及び設計データへのポインタ４３によりデータの階層関係を含む設計データの管理が行われる。設計データへのポインタ４３は、例えば、設計データベースファイル１１内の設計データＡＬＵ４５をポイントすることにより設計データをアクセスする。

【００２２】本システムでは、さらに図５に示す設計進行状況管理テーブル５５（図１の１２に対応）により設計データの進行状況の管理を行う。

【００２３】設計進行状況管理テーブル５５には、各設計データごとに、設計データ名５０、設計工程５１、設計進行状況５２、使用ＷＳ名５３、参照ＷＳ名５４が記録される。これらのデータは、管理用ワークステーション１０にて設計データベース１１にデータを入出力する毎に、データベース管理プログラムが設計進行状況管理プログラムを起動することによって作成／更新される。

【００２４】図５の設計工程５１は、設計データがどの階層レベルにあるかを示し、ここでは記述種別で階層レベルを規定している。設計進行状況５２は、設計データがどの様な設計進行状況にあるかをコードで表わし管理する。

【００２５】設計進行状況５２のコードは、この例では'0'から'4'まで5段階の進行状況を表わす。コード'0'はデータが未作成であることを示し、コード'1'はデータが作成途中であることを示す。また、コード'2'はデータが完成していることを示し、コード'3'は作成途中のデータで現在編集中である（誰かが編集のためにオープンしている）ことを示す。さらに、コード'4'が完成しているデータで現在編集中である（誰かが改造またはバージョンアップのためにオープンしている）ことを示す。設計が完成したかどうかの情報は、各ワークステーション上のＣＡＤプログラムにより設計データを編集後、設計データベース１１に格納する際に、管理情報としてデータベース管理プログラムに従って設計者が入力する。

【００２６】使用ＷＳ名５３は、編集のためにデータを現在使用しているＷＳ名を記録し、参照ＷＳ名５４はシミュレーションのためにデータを現在参照しているＷＳ名が記録される。例えば、図５のＡ２のデータは、構成が'論理記述'、進行状況５２のコードが'1'なので、論理記述の工程の作成途中のデータであると分かる。ここで、ＷＳ３にてＡ２のデータの編集作業を始めたとすると、設計進行状況のコードは'1'から'3'に書き換えられ、また、使用ＷＳ名にＷＳ３が書き込ま

れる。このようにして、設計進行状況管理テーブル５５に現在の各設計データの進行状況が反映される。

【００２７】図８は、設計進行状況管理プログラムの処理の流れを示すフローチャートである。まず、ステップ８００にて設計データの入出力を判断し、データベースへの入力であればステップ８０８、そうでなければステップ８０１へ移行する。ステップ８０１では、編集のためのデータ取り出しか否かを判断し、編集のためのデータ取り出しであればステップ８０２へ移行し、参照のためのデータ取り出しであれば、ステップ８１４により参照ワークステーション名を設計進行状況管理テーブル５５に書き込み、処理を終了する。ステップ８０２では、現在の設計進行状況コードを判断し、コードが'０'，'１'であればステップ８０３で設計進行状況コードを'３'に変更し、'２'であればステップ８０４により設計進行状況コードを'４'に変更し、ステップ８０５へ移行する。ステップ８０５では、使用ワークステーション名を設計進行状況管理テーブル５５に書き込む。ステップ８０６では、参照ワークステーションが存在するか判断し、あれば、ステップ８０７により参照ワークステーションに参照データの編集が開始されたことを通知し、なければ処理を終了する。

【００２８】ステップ８０８では、設計データが設計完了かどうかの設計者の指示データから判断し、設計完了であればステップ８０９へ、完了でなければステップ８１２へ移行する。ステップ８０９では、現在の設計進行状況コードを調べ、コードが'３'ならばステップ８１１へ移行し、コードが'４'ならばステップ８１０により新規バージョンのデータとして設計データを格納してステップ８１１へ進む。ステップ８１１では、現在の設計進行状況コードを'２'に変更する。ステップ８１２では、参照ワークステーションが存在するか判断し、あれば、ステップ８１３により参照ワークステーションに参照データの編集が終了したことを通知し、なければ処理を終了する。

【００２９】図６は、設計進行状況管理テーブル５５（図５）のデータを使って、各ワークステーションの設計進行状況表示プログラムにより各ワークステーションの画面６６上に表示される設計進行状況の図示例を示す。

【００３０】図６において、設計進行状況表示ウインドウ６７内に、データ名６１及び工程を現す図形６０により一つの設計データを表現し、階層関係を表わす折れ線６２により各データ間の関係を示している。ここで、設計途中のデータの場合には、工程を現す図形がハッチング６３をかけて表示される。また、他のワークステーションにより編集が行われているデータには、編集が行われていることを示す図形６４およびワークステーション名６５が表示される。この設計進行状況表示は、設計進行状況が変わるたびに設計進行状況表示プログラムにより更新され、常に最新の設計進行状況が表示される。

【００３１】なお、他のワークステーションからの通知があった場合には、図１１に示すように、通知があったことを示す図形１１０を、通知を発したワークステーションに付随して表示するようにしてもよい。通知内容は、マウス等により指示されるカーソル１１１を図形１１０に重ねて、マウスボタンを押すことにより、新たなウィンドウが開かれそのウィンドウ内に表示されるようにすることができる。

【００３２】図７は、シミュレーションの為の設計データとしてどの階層のデータを使用するかを指示する際の表示例を示す。

【００３３】シミュレーションの為の設計データ使用時には、まず、マウス等のポインティング入力装置により操作されるカーソル７０を、必要とする設計データの工程を表わす図形７１に重ねあわせてマウスボタンを押すことによりデータを指示する。指示されたデータは、そのデータの図形がハイライト表示され指示されたことを示す。図７ではハイライト表示を点線により表現している。この時、表示されたデータが編集中の場合には、警告メッセージが画面下部に表示される。次に、必要とするデータに対して上記操作を繰り返し行い、コマンドメニュー７７のデータｃｏｐｙコマンド７６にカーソルを重ねてマウスボタンを押すことにより、最上位のＦＵから指示したデータ７１，７２，７３，７４，７５までの各設計データが設計データベース１１より自ワークステーション内にＣＯＰＹされ、シミュレーションの為に使用可能となる。

【００３４】図９は、各ワークステーションにて動作する設計進行状況表示プログラムの処理の流れを示すフローチャートである。この設計進行状況表示プログラムは、各ワークステーションにてＯＳによりワークステーション起動時に自動起動され、ワークステーションの停止時まで連続して動作する。

【００３５】図９において、まずステップ９００では、設計進行状況管理テーブル５５が更新されたかを判断し、変更があればステップ９０１へ、なければステップ９０４へ移行する。ステップ９００の、プログラム起動後最初の判断は「更新あり」と判断する。ステップ９０１では、設計進行状況管理テーブル５５のデータを取り込む。ステップ９０２では、既に表示されている設計進行状況表示を消去する。ステップ９０３では、ステップ９０１のデータを使って設計進行状況を画面上に表示する。ステップ９０４では、設計進行状況表示画面中でマウスのボタンが押されたか判断し、押されていればステップ９０５へ、押されていなければ再びステップ９００へ戻る。ステップ９０５では、マウスの入力座標値からメニューの中のｃｏｐｙコマンドが指示されたか判断し、ｃｏｐｙコマンド指示であればステップ９０９へ、なければステップ９０６へ進む。ステップ９０６では、

設計データの図形がマウスにより指示されたか否かの判断を行い、設計データの指示であればステップ９０７へ進み、そうでなければステップ９００に戻る。ステップ９０７では、指示された設計データ名を取り出し、ｃｏｐｙ用テーブルに情報をセットし、ステップ９０８により、指示された設計データの図形をハイライト表示する。ステップ９０９では、ｃｏｐｙ用テーブルに記録されている設計データ全てをデータベースから自ワークステーション上にｃｏｐｙする。この時ｃｏｐｙする設計データが既に他のワークステーションにより編集中の場合には、画面下部に編集中であることの警告を表示する。ステップ９１０では、データベースからのｃｏｐｙが終了した設計データのハイライト表示を通常表示にもどし、ステップ９００へ戻る。

【００３６】図１０は、図９のステップ９０３の処理フローチャートのである。

【００３７】まずステップ１００１では、管理用ワークステーション１０の設計データベース１１から設計データの階層構造データを取り込み、設計進行状況表示画面（図６）に於ける各表示データの表示位置を算出し、各データ間の階層関係を表す折れ線６２を表示する。ステップ１００２では、設計進行状況管理テーブル５５から設計進行状況データを一つ取り込む。ステップ１００３では、取り込んだ設計進行状況データの工程により、機能記述であればステップ１００４へ、論理記述であればステップ１００５へ、回路記述であればステップ１００６へ移行する。ステップ１００４では、設計進行状況コードにより、コードが２，４であればステップ１００７へ、コードが０，１，３であればステップ１００８へ進む。ステップ１００７では、ステップ１００１で算出した表示位置に機能記述工程を表す図形とデータ名を表示し、ステップ１０１３へ移行する。ステップ１００８では、ステップ１００７と同様にして機能記述工程を表す図形をハッチングをかけて表示すると共にデータ名を表示しステップ１０１３へ移行する。

【００３８】ステップ１００３で工程が論理記述であった場合、ステップ１００５では、設計進行状況コードにより、コードが２，４であればステップ１００９へ、コードが０，１，３であればステップ１０１０へ進む。ステップ１００９では、ステップ１００１で算出した表示位置に論理記述工程を表す図形とデータ名を表示し、ステップ１０１３へ移行する。ステップ１０１０では、ステップ１００８と同様にして論理記述工程を表す図形をハッチングをかけて表示すると共にデータ名を表示し、ステップ１０１３へ移行する。

【００３９】ステップ１００３で工程が回路記述であった場合、ステップ１００６では、設計進行状況コードにより、コードが２，４であればステップ１０１１へ、コードが０，１，３であればステップ１０１２へ進む。ステップ１０１１では、ステップ１００１で算出した表示位置に回路記述工程を表す図形とデータ名を表示し、ステップ１０１３へ移行する。ステップ１０１２では、ステップ１０１１と同様にして回路記述工程を表す図形をハッチングをかけて表示すると共にデータ名を表示し、ステップ１０１３へ移行する。

【００４０】ステップ１０１３では、設計データを編集のために使用しているＷＳがあるか判断し、あればステップ１０１４により使用ＷＳを表す図形と使用ＷＳ名をステップ１００１で算出した表示位置を基にして表示し、ステップ１０１５へ進む。使用ＷＳがなければ、直ちにステップ１０１５へ移行する。ステップ１０１５では、設計進行状況管理テーブル５５の全てのデータを処理したか判断し、処理終了でなければステップ１００２へ戻り、終了であれば処理を終了する。

【００４１】上記実施例では、設計進行状況管理テーブル５５を管理用ワークステーション１０に持たせたが、すべてのワークステーションに同様の設計進行状況管理テーブルをもたせて管理することもできる。

【００４２】また、設計途中のデータに対してそのデータを表わす図形をハッチングすることにより設計途中であることを示すようにしたが、図１２（ａ）のように図形形状を代えたり、同図（ｂ）のように図形の一部の船首を変えたり、同図（ｃ）のように図形の一部のみにハッチングを施すようにしてもよい。あるいは、図形の表示色を変えることもできる。さらに、設計の完成度をパーセントの数値で設計者から入力し、同図（ｄ）のようにパーセント値１２０を表示し、あるいは設計の完成度のパーセント値に応じて、同図（ａ）の図形形状の変化の程度、同図（ｂ）の図形の一部の線種変更の程度、または同図（ｃ）のハッチングを施す領域の程度、を制御することも可能である。

【００４３】

【発明の効果】本発明によれば、設計データの現在の進行状況が図形として表示されるため、データベースに問い合わせることなく、どの設計データがどの様な設計進行状況にあるかが容易に掌握できる。また、設計データのシミュレーションでの使用の為の操作が、設計進行状況の表示を使用して行えるので、指示誤りを少なくすることができる。

【図面の簡単な説明】

【図１】本実施例ＣＡＤシステムの構成図。

【図２】階層データの説明図。

【図３】階層データの説明図。

【図４】データベースのデータ管理の説明図。

【図５】設計進行状況管理テーブルの説明図。

【図６】設計進行状況の表示例。

【図７】設計進行状況表示による設計データ使用指示の説明図。

【図８】設計進行状況管理プログラムの動作フローチャート。

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【図９】設計進行状況表示プログラムの動作フローチャート。

【図１０】設計進行状況表示処理の動作フローチャート。

【図１１】設計進行状況表示の他の例の説明図。

【図１２】表示図形の他の例の説明図。

【符号の説明】

１０　管理用ワークステーション

＊１１　設計データベースファイル

１２　設計進行状況管理テーブル

１３　設計用ワークステーション

１４　設計用ワークステーション

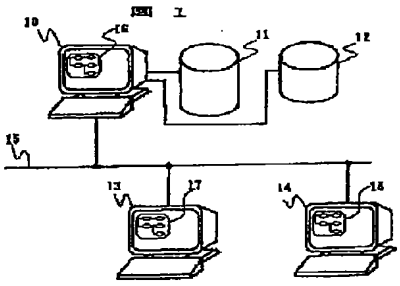
１５　ネットワーク

１６　設計進行状況表示画面

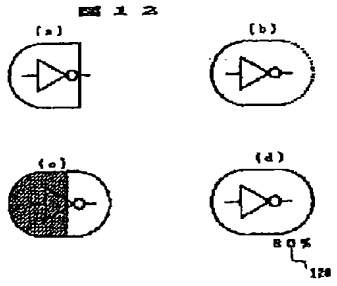
１７　設計進行状況表示画面

＊１８　設計進行状況表示画面

【図１】

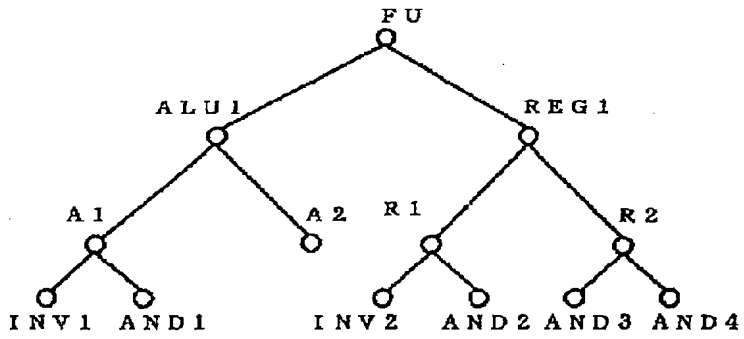


【図１２】



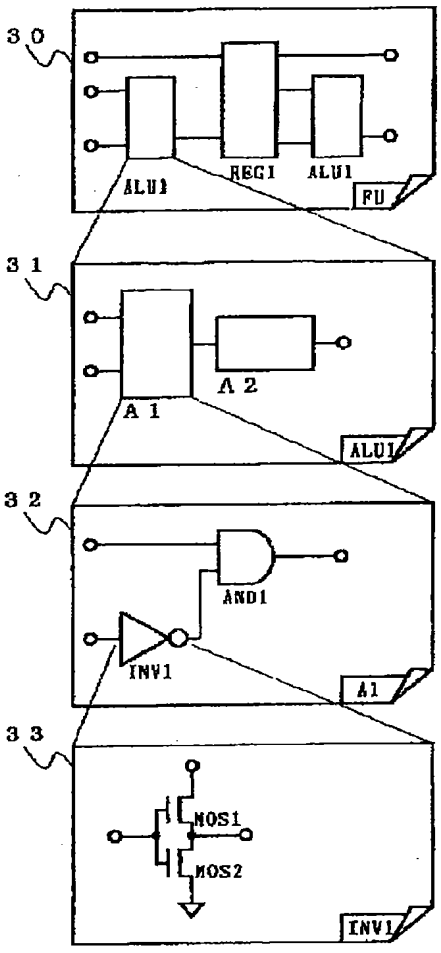
【図２】

図　２



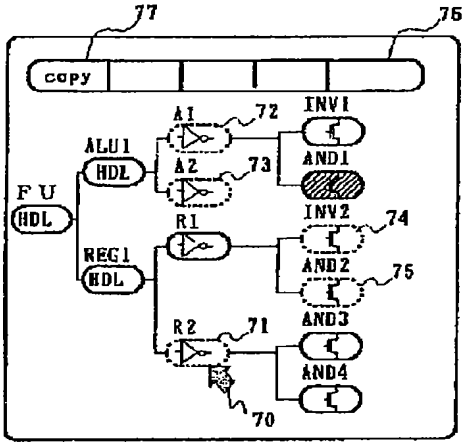
【図3】

図 3



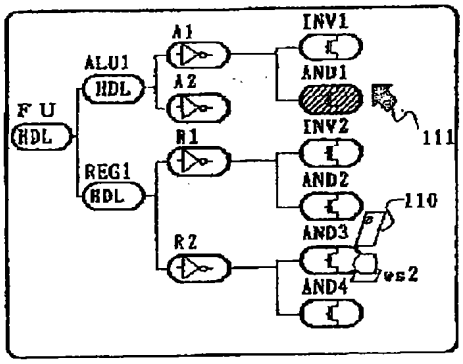
【図7】

図 7



【図11】

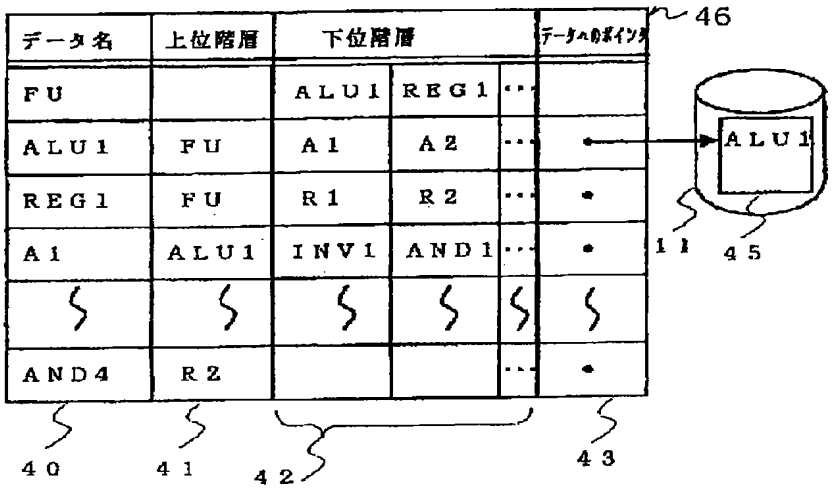
図 11



【図4】

図 4

データ名	上位階層	下位階層			データへのポインタ
FU		ALU1	REG1	・・・	
ALU1	FU	A1	A2	・・・	•
REG1	FU	R1	R2	・・・	•
A1	ALU1	INV1	AND1	・・・	•
∫	∫	∫	∫	∫	∫
AND4	R2			・・・	•



【図5】

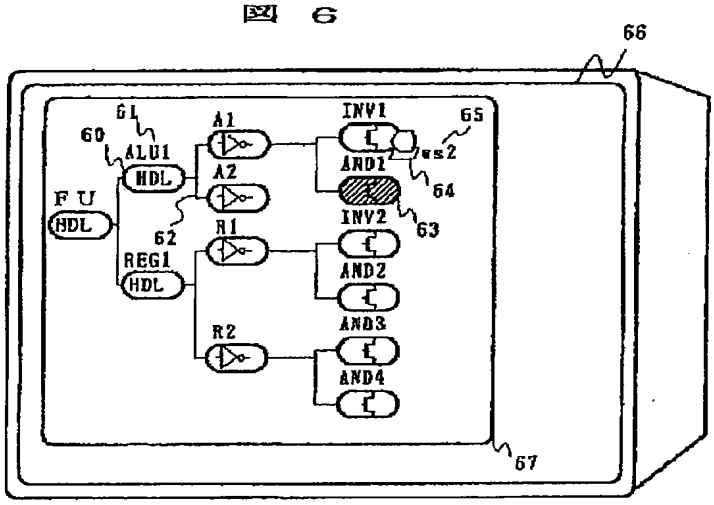
図 5

55

データ名	工程	進行状況	使用WS名	参照WS名
ALU1	機能記述	2		WS2
REG1	機能記述	2		WS2
A1	論理記述	4	WS1	
A2	論理記述	1		
∫	∫	∫	∫	∫
AND4	回路記述	0		

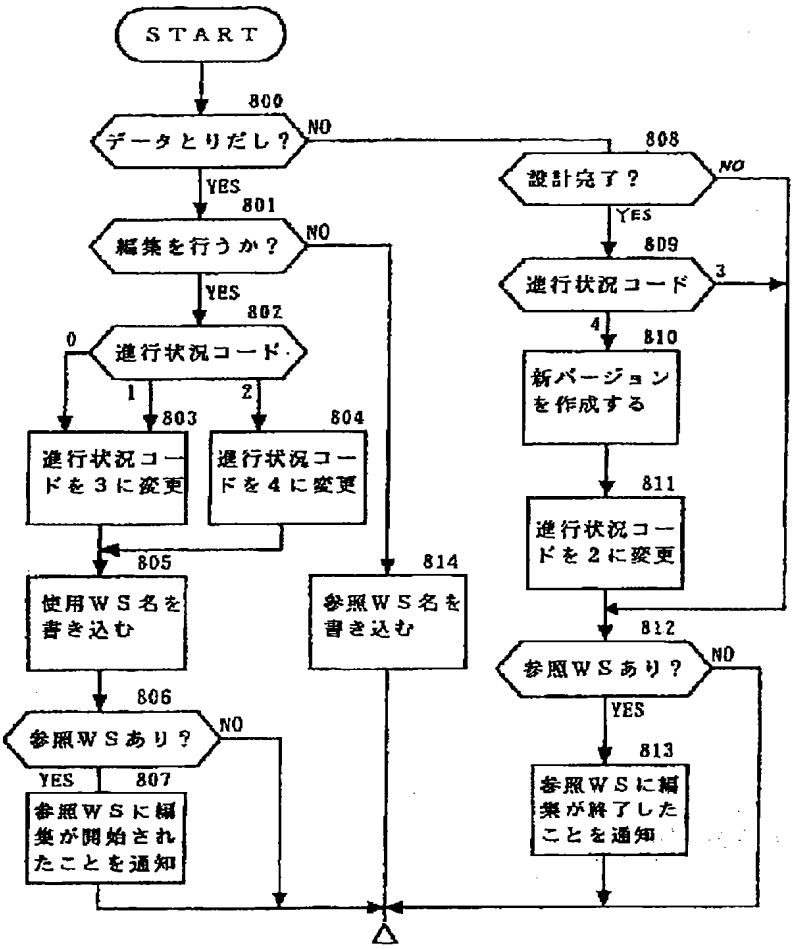
【図6】

図 6


66
61
60
ALU1
HDL
A1
A2
INV1
65
ws2
AND1
64
63
INV2
AND2
AND3
AND4
F U
HDL
62
R1
REG1
HDL
R2
67

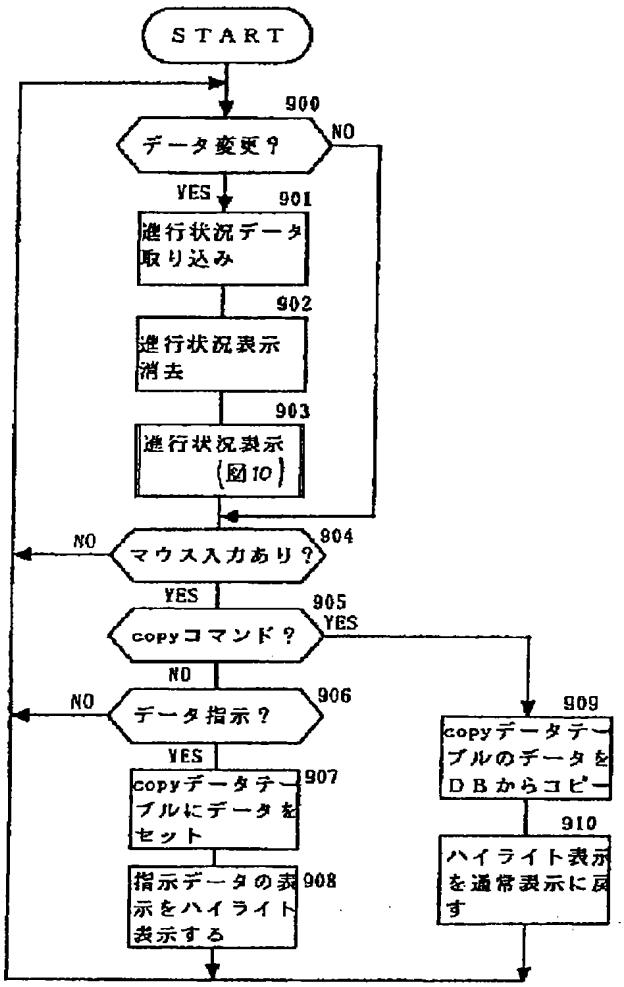
[図8]

図 8


START
800
データとりだし？
NO
YES
801
編集を行うか？
NO
YES
802
進行状況コード
0
1
2
803
進行状況コードを３に変更
804
進行状況コードを４に変更
805
使用ＷＳ名を書き込む
806
参照ＷＳあり？
NO
YES
807
参照ＷＳに編集が開始されたことを通知
814
参照ＷＳ名を書き込む
808
設計完了？
NO
YES
809
進行状況コード
3
4
810
新バージョンを作成する
811
進行状況コードを２に変更
812
参照ＷＳあり？
NO
YES
813
参照ＷＳに編集が終了したことを通知

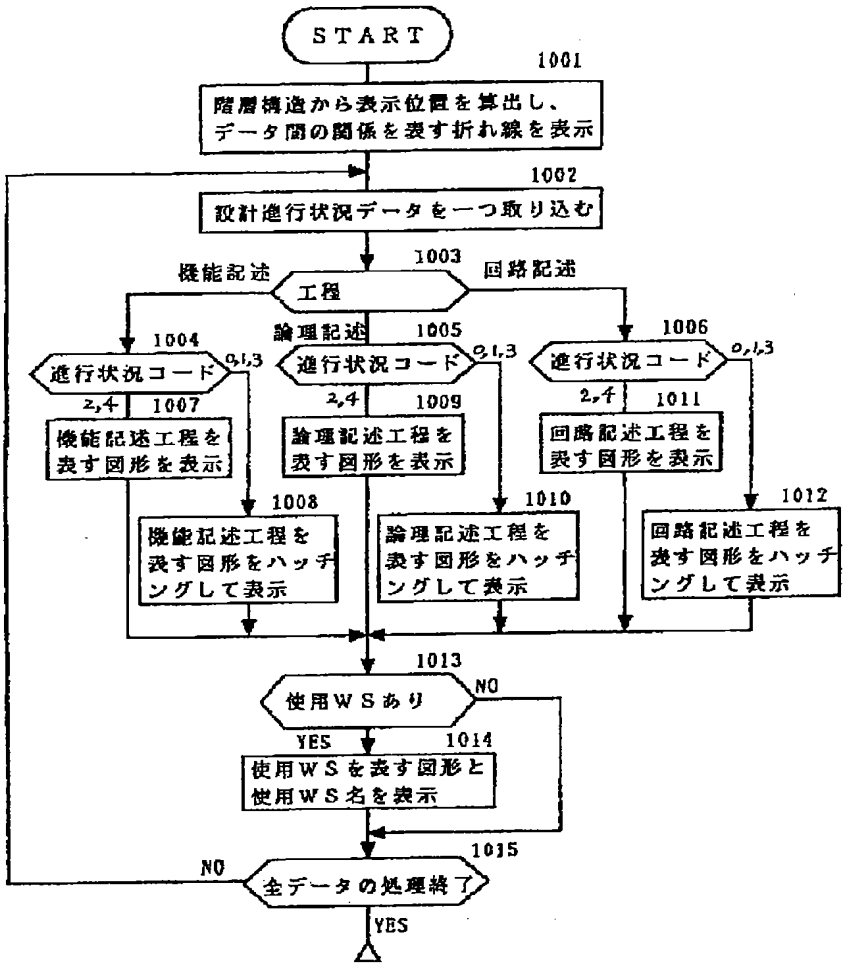
【図9】

図 9


START
900
データ変更？
NO
YES
901
進行状況データ取り込み
902
進行状況表示消去
903
進行状況表示 (図10)
NO
904
マウス入力あり？
YES
905
copyコマンド？
YES
NO
NO
906
データ指示？
YES
909
copyデータテーブルのデータをＤＢからコピー
907
copyデータテーブルにデータをセット
910
ハイライト表示を通常表示に戻す
908
指示データの表示をハイライト表示する

【図10】

図 10


START
1001
階層構造から表示位置を算出し、データ間の関係を表す折れ線を表示
1002
設計進行状況データを一つ取り込む
1003
工程
機能記述
論理記述
回路記述
1004
進行状況コード
0,1,3
2,4
1007
機能記述工程を表す図形を表示
1008
機能記述工程を表す図形をハッチングして表示
1005
進行状況コード
0,1,3
2,4
1009
論理記述工程を表す図形を表示
1010
論理記述工程を表す図形をハッチングして表示
1006
進行状況コード
0,1,3
2,4
1011
回路記述工程を表す図形を表示
1012
回路記述工程を表す図形をハッチングして表示
1013
使用ＷＳあり
NO
YES
1014
使用ＷＳを表す図形と使用ＷＳ名を表示
1015
NO
全データの処理終了
YES

PATENT ABSTRACTS OF JAPAN

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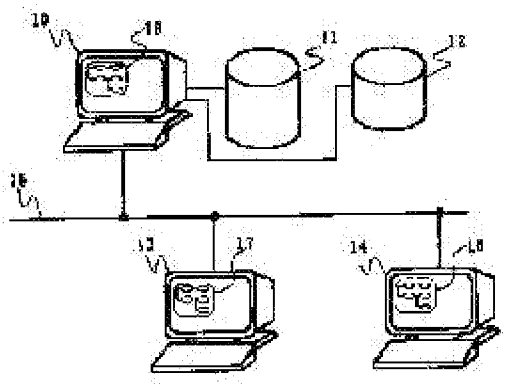
(72)Inventor : YAMAMOTO TETSUYA
SUZUKI GORO
NATSUME KOICHIRO

(54) DISTRIBUTED DESIGN SUPPORT METHOD/SYSTEM

(57)Abstract:

PURPOSE: To facilitate the grasp of the progress situation of design at the time of distributed design by managing the design progress situation of respective constitution elements and displaying the design progress situation on the display screens of terminal equipments which respective designers use.



CONSTITUTION: A design object is divided into plural hierarchies. When plural designers design the respective constitution elements of the hierarchies in parallel by a network 15 by using the terminals which are mutually connected, the design progress situations of the respective constitution elements are managed and the design progress situations are displayed on the display screens 16-18 of the terminal equipments which the respective designers use. Here, the respective constitution elements are hierarchically displayed in different graphics for the process types of the constitution elements. Thus, the present progress situation of design data is displayed as the graphic. Thus, it can easily be grasped which design data is in what design progress situation without making an inquiry to a data base. Required design data can easily be obtained and an indication error can be reduced.

LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

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[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The distributed design exchange approach characterized by what displays on the display screen of the terminal unit with which the object for a design is divided into two or more hierarchies, the design progress situation of each component manages in the distributed design exchange approach that two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network, and each architect is using the design progress situation.
[Claim 2] The distributed design exchange approach according to claim 1 characterized by displaying said each component hierarchical with a different graphic form for every process classification of the component.
[Claim 3] The distributed design exchange approach according to claim 2 characterized by a design displaying the graphic form of an incomplete component in distinction from the graphic form of the component which the design has completed.
[Claim 4] The distributed design exchange approach according to claim 2 characterized by accompanying the graphic form of the component which is [current] under edit, and displaying the graphic form in which existence of the terminal unit under current edit is shown.
[Claim 5] The distributed design exchange approach according to claim 1 characterized by ordering the design data of the component through said network by directing the component displayed on said display screen.
[Claim 6] The distributed design exchange approach according to claim 1 characterized by emitting advice to that effect to a terminal unit besides the above from said a certain terminal unit when other terminal units are referring to the design data of the component at the time of edit initiation / termination of the component of the arbitration in a certain terminal unit.
[Claim 7] the case where other terminal units are referring to the design data of the component at the time of edit initiation / termination of the component of the arbitration in a certain terminal unit -- from said terminal unit of a certain -- said -- others -- a terminal unit -- advice to that effect -- emitting -- being concerned -- others -- the distributed design exchange approach according to claim 2 characterized by to display the graphic form in which it is shown that the graphic form of the component which said terminal unit of a certain is editing on the display screen of a terminal unit was accompanied, and there was the advice concerned.
[Claim 8] The distributed design exchange approach according to claim 7 characterized for the window which displays the content of advice by directing the graphic form in which it is shown that there was said advice by open Lycium chinense.
[Claim 9] The distributed design exchange approach according to claim 2 which specifies whether the design data of which two or more of said hierarchies' component is used by directing the graphic form of the component on said display screen, and is characterized by to order the design data of the component which the display attribute of the this specified graphic form was changed, and was specified through a network in case simulation of actuation for [said] a design is performed in the terminal unit of arbitration.

[Claim 10] In the distributed computer-aided design to which the object for a design is divided into two or more hierarchies, and two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network At least one Administrative Station which manages the design progress situation of each of said component by two or more architects while managing the design database which stores a design data, It has two or more terminal units for a design which two or more architects use for a design. Said Administrative Station The engineering-data-management table which manages the hierarchy connection relation of each of said component, and the response relation between the design data in said design database, and each component, The progress situation managed table which manages the design progress situation of the design data of each component, It has a means to update said progress situation managed table in the case of transfer of the design data between said terminal units for a design. Said terminal unit for a design Distributed computer-aided design characterized by having a means to display the design progress situation of each of said component on a display screen according to the content of said progress situation managed table, and a means to input setting out and update information of the content of said progress situation managed table.
[Claim 11] Said progress situation managed table is distributed computer-aided design according to claim 10 characterized by holding the process classification and a progress status code for said every component.
[Claim 12] Said progress situation managed table is distributed computer-aided design characterized by holding further either [at least] a terminal unit name while editing the design data of the component concerned for said every component, or a terminal unit name while referring to the design data of the component concerned.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] this example CAD structure-of-a-system drawing.
[Drawing 2] The explanatory view of hierarchy data.
[Drawing 3] The explanatory view of hierarchy data.
[Drawing 4] The explanatory view of the data control of a database.
[Drawing 5] The explanatory view of a design progress situation managed table.
[Drawing 6] The example of a display of a design progress situation.
[Drawing 7] The explanatory view of the design-data activity directions by design progress situation display.
[Drawing 8] The operation flow chart of a design progress situation manager.
[Drawing 9] The operation flow chart of a design progress situation display program.
[Drawing 10] The operation flow chart of design progress situation display processing.
[Drawing 11] The explanatory view of other examples of design progress situation display.
[Drawing 12] The explanatory view of other examples of an indicator-chart form.
[Description of Notations]
10 Administrative Workstation
11 Design Database File
12 Design Progress Situation Managed Table
13 Workstation for Design
14 Workstation for Design
15 Network
16 Design Progress Situation Display Screen
17 Design Progress Situation Display Screen
18 Design Progress Situation Display Screen

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the means of displaying for management of the drawing information at the time of two or more architects doing the distributed concurrent design of a VLSI logic diagram, a circuit diagram, and the mask pattern by the dialogue with a computer, and management.
[0002]
[Description of the Prior Art] In the design of VLSI, since the circuit magnitude is as large as millions transistors, the hierarchical design is performed. Therefore, also in the CAD system which supports those designs, design data-hierarchy management and common management of the design data by two or more architects are performed.
[0003] For example, managing the relation between drawings, or adding the fix information text which shows a correction good improper flag, a correction person name, a modification time, and a correction finish time to a design data like the publication to JP,2-48774,A, and two or more architects overlapping the same design data, and making it not correct is performed like a publication in a publication-number - 310473 [No.] official report by including the parentage between each drawing in the directory information of drawing data.
[0004]
[Problem(s) to be Solved by the Invention] In an above-mentioned management method, although an architect can know what kind of layered structure an engineering-drawing side has, the input for retrieval is needed. For example, what kind of thing the drawing of the low order hierarchy of a certain drawing A has needs to make a CAD system search by using the drawing name A as a key. Moreover, since, as for whether it is under [edit] ********, the CAD program has managed the drawing with other architects, it does not understand until it is going to use the drawing by the CAD system. Furthermore, the architect was performing management about whether the engineering-drawing side is carrying out the completion of a design thoroughly. For this reason, when simulation is performed combining other architects' design data, the architect had to manage combining the data of which version of which level of hierarchy data it would use, management is complicated and a mistake tended to happen.
[0005] For example, in simulation, simulation is performed to a design data with a hierarchy as shows drawing 3 using the hierarchy level to need. In drawing 3 , a drawing 30 is the top drawing of an arithmetic unit FU, and components ALU1 and REG1 are described by functional description. A drawing 31 is a drawing of the low order hierarchy of the component ALU 1 of a drawing 30, and components A1 and A2 are described by functional description. A drawing 32 is the logic diagram of the low order hierarchy drawing of the component A1 of a drawing 31, and is constituted by the logic symbol of AND1 and INV1. A drawing 33 is the circuit diagram of the low order hierarchy drawing of INV1 of a drawing 32, and consists of MOS transistors MOS1 and MOS2. Although omitted in drawing 3 , it has the same layered structure as a component ALU 1 also about the component REG 1, and has a

layered structure as specifically shown in drawing 2 .
[0006] Here, when performing a simulation about the arithmetic unit FU of a drawing 30, about a component ALU 1, the component A2 of a drawing 31 is used as functional description, using functional description about the component REG 1 of a drawing 30. About the component A1 of a drawing 31, further, it is the thing using INV1 as circuit level of a low order hierarchy's drawing 33 further, and AND1 of a low order hierarchy's drawing 32 is replaced with what was used as logical level. Thus, performing simulation using an available low order hierarchy's drawing part is performed. If using the drawing of the hierarchy who changes with each data performs simulation on detailed level like circuit level, it will be because it says [that computation time's starting for a long time and two or more architects' design progress are not uniform although the precision of simulation improves, and all a certain hierarchy's design datas have not necessarily gathered], and will be because it is going to adopt the most effective simulation level about each data.
[0007] however, the design data of the level which can be used for simulation is which conventionally -- since the architect needed to perform that management -- directions of data -- a mistake -- easy -- there was a problem that the response to the newest design condition was overdue.
[0008] The object of this invention makes easy control of the progress situation of the design at the time of a distributed design, and is to offer the distributed design exchange approach and system which can acquire immediately the information which each architect needs easily.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned object, the distributed design exchange approach by this invention divides the object for a design into two or more hierarchies, the design progress situation of each component manages in the distributed design exchange approach that two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network, and it makes display on the display screen of the terminal unit with which each architect is using the design progress situation.
[0010] Preferably, it is a different graphic form for every process classification of the component, and said each component is displayed hierarchical. A design displays the graphic form of an incomplete component in distinction from the graphic form of the component which the design has completed in that case. Moreover, the graphic form of the component which is [current] under edit is accompanied, and the graphic form in which existence of the terminal unit under current edit is shown is displayed.
[0011] Moreover, it enables it to order the design data of the component through said network by directing the component displayed on said display screen.
[0012] In the distributed computer-aided design to which the distributed computer-aided design by this invention divides the object for a design into two or more hierarchies, and two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network At least one Administrative Station which manages the design progress situation of each of said component by two or more architects while managing the design database which stores a design data, It has two or more terminal units for a design which two or more architects use for a design. Said Administrative Station The engineering-data-management table which manages the hierarchy connection relation of each of said component, and the response relation between the design data in said design database, and each component, The progress situation managed table which manages the design progress situation of the design data of each component, It has a means to update said progress situation managed table in the case of transfer of the design data between said terminal units for a design. Said terminal unit for a design It is characterized by having a means to display the design progress situation of each of said component on a display screen according to the content of said progress situation managed table, and a means to input setting out and update information of the content of said progress situation managed table.
[0013] Preferably, said progress situation managed table holds the process classification and a progress status code for said every component.
[0014] Moreover, said progress situation managed table holds further either [at least] a terminal unit name while editing the design data of the component concerned for said every component, or a terminal

unit name while referring to the design data of the component concerned.
[0015]
[Function] The design progress situation of each design data can be held easily, without asking a database, since the progress situation of each design data which each architect is designing is displayed on the display screen of the terminal unit which each architect is using. Moreover, since the design data of the progress situation can be ordered and used by directing the progress situation of each displayed design data, the design data to need is obtained easily. Furthermore, since the actuation for an activity in the simulation of a design data can carry out using the display of a design progress situation, it can lessen a directions error.
[0016]
[Example] Hereafter, the example of this invention is explained according to a drawing.
[0017] Drawing 1 shows this example CAD structure of a system. In this drawing, 10 is an administrative workstation (WS) and a network where in a design database file and 12 a design progress situation managed table, and 13 and 14 connect with the workstation for a design, and 15 connects [11] each workstation mutually. Here, although two workstations 13 and 14 for a design are shown for convenience, three or more sets can also connect. Each of workstations 10, 13, and 14 performs CAD programs (for example, a logic diagram edit editor, a circuit diagram edit editor, etc.) on the workstation concerned. Storing management of the design datas, such as a logic diagram side created by each workstation, is carried out by administrative workstation 10 through a network 15 at the design database file 11 in that case. Of course, by workstation 10, you may be the system which only manages by not editing. Moreover, although it illustrated so that it might be stored in storage with separate design database file 11 and design progress situation managed table 12, you may make it stored in the same storage.
[0018] In this system, it makes it easy for each architect to hold the whole design progress situation by managing the design progress situation of each design data on the design progress situation managed table 12, and displaying the management data as design progress situations 16, 17, and 18 on the display screen of workstations 10, 13, and 14.
[0019] Drawing 2 shows the example of the design data-hierarchy structure designed by this CAD system.
[0020] This drawing expresses the layered structure of a real number arithmetic unit called FU, and supports the example of each hierarchy drawing of drawing 3 mentioned above. An arithmetic unit FU consists of a drawing ALU 1 described on functional description level, and a drawing REG 1 so that drawing 2 may show. ALU1 consists of the drawings A1 and drawings A2 which were described on logic description level. REG1 consists of a drawing R1 of logic description level, and a drawing R2 similarly. Furthermore, A1 consists of the drawings INV1 and Drawings AND 1 by which circuit description level description was carried out. Similarly, R1 consists of the drawings INV2 and Drawings AND 2 of circuit description level, and R2 consists of the drawings AND 3 and Drawings AND 4 of circuit description level.
[0021] The design data of each of these components is managed as a design database 11 on the managed table 46 as shown in drawing 4 . Management of the design data which includes data-hierarchy relation in the managed table 46 corresponding to each design data with the pointer 41 to high order hierarchy data, the pointer 42 to a low order hierarchy, and the pointer 43 to a design data is performed. The pointer 43 to a design data accesses a design data by pointing at design-data ALU45 in the design database file 11.
[0022] In this system, the progress situation of a design data is managed on the design progress situation managed table 55 (it corresponds to 12 of drawing 1) further shown in drawing 5 .
[0023] The design data name 50, a design process 51, the design progress situation 52, the activity WS name 53, and the reference WS name 54 are recorded on the design progress situation managed table 55 for every design data. Whenever it outputs and inputs data to a design database 11 by administrative workstation 10, these data are created / updated when a database manager starts a design progress situation manager.

[0024] The design process 51 of drawing 5 showed in which hierarchy level a design data would be, and has specified hierarchy level by description classification here. The design progress situation 52 expresses with a code whether a design data is in what kind of design progress situation, and is managed.
[0025] The code of the design progress situation 52 expresses five steps of progress situations with this example from '0' to '4'. It is shown that the code '0' has not created data and a code '1' shows that data are in the middle of creation. Moreover, it is shown that data have completed the code '2' and a code '3' shows what is current been under edit by the data in the middle of creation (it opens for someone's edit). Furthermore, what is been under edit now by the data which the code '4' has completed (someone opens for modification or version up) is shown. In case the information on whether the design was completed or not is stored in a design database 11 after editing a design data by the CAD program on each workstation, according to a database manager, an architect inputs it as management information.
[0026] The activity WS name 53 records WS name which is using data now for edit, and WS name to which the reference WS name 54 is referring to data now for simulation is recorded. For example, the data of A2 of drawing 5 turn out that a configuration is data in the middle of creation of the process of logic description since the code of 'logic description' and the progress situation 52 is '1'. Here, supposing it begins the editing task of data of WS three A2, the code of a design progress situation will be rewritten from '1' to '3', and WS3 will be written in an activity WS name. Thus, the progress situation of each current design data is reflected in the design progress situation managed table 55.
[0027] Drawing 8 is a flow chart which shows the flow of processing of a design progress situation manager. First, I/O of a design data is judged at step 800, and if it is an input to a database, it will shift to step 808, otherwise, step 801. At step 801, it judges whether it is the data ejection for edit, if it is the data ejection for edit, it will shift to step 802, and if it is the data ejection for reference, a reference workstation name will be written in the design progress situation managed table 55 by step 814, and processing will be ended. At step 802, a current design progress status code is judged, if codes are '0' and '1', a design progress status code will be changed into '3' at step 803, and if it is '2', a design progress status code will be changed into '4' by step 804, and it will shift to step 805. At step 805, the workstation name used is written in the design progress situation managed table 55. At step 806, it notifies that judged whether a reference workstation would exist, and edit of reference data was started by the reference workstation by step 807 when it was, and if there is nothing, processing will be ended.
[0028] At step 808, judging from the directions data of the architect of being the completion of a design, if a design data is the completion of a design, if it is not completion, it will shift to step 809 to step 812. a design progress status code current at step 809 -- investigating -- a code -- '3' -- if it becomes -- step 811 -- shifting -- a code -- '4' -- if it becomes, a design data will be stored as data of a new version by step 810, and it will progress to step 811. A current design progress status code is changed into '2' at step 811. At step 812, it notifies that judged whether a reference workstation would exist, and edit of reference data was completed to the reference workstation by step 813 when it was, and if there is nothing, processing will be ended.
[0029] Drawing 6 shows the example of a graphic display of the design progress situation displayed by the design progress situation display program of each workstation on Screen 66 of each workstation using the data of the design progress situation managed table 55 (drawing 5).
[0030] In drawing 6 , the graphic form 60 which expresses a data name 61 and a process in the design progress situation display window 67 expresses one design data, and the polygonal line 62 showing hierarchical relationship shows the relation between each data. Here, the graphic form showing a process is displayed on it, applying hatching 63 in the case of the data in the middle of a design. Moreover, the graphic form 64 and the workstation name 65 which show that edit is performed are displayed on the data to which edit is performed by other workstations. Whenever this design progress situation display changes a design progress situation, it is updated by the design progress situation display program, and the newest design progress situation is always displayed.
[0031] In addition, when there is advice from other workstations, you may make it display the graphic form 110 in which it is shown that there was advice along with the workstation which emitted advice, as

shown in drawing 11 . In the cursor 111 directed with a mouse etc., in piles, by pressing a mouse button, a new window is opened by the graphic form 110 and the content of advice can be displayed on it in the window.

[0032] Drawing 7 shows the example of a display at the time of directing of which hierarchy data are used as a design data for simulation.

[0033] Data are directed by laying on top of the graphic form 71 showing the process of a design data which needs first the cursor 70 operated with pointing input devices, such as a mouse, at the time of the design-data activity for simulation, and pressing a mouse button. The directed data show that highlighting of the graphic form of the data was carried out, and it was directed. In drawing 7 , the dotted line is expressing highlighting. When the displayed data are editing at this time, a warning message is displayed on a bottom of screen. Next, each design data to data 71, 72, 73, 74, and 75 which directed cursor to the data copy command 76 of a command menu 77 from the top FU by pressing a mouse button in piles by carrying out by repeating the above-mentioned actuation to the data to need is COPY(ed) in a self-workstation, and becomes usable because of simulation from a design database 11.

[0034] Drawing 9 is a flow chart which shows the flow of processing of a design progress situation display program in which it operates by each workstation. Auto-boot of this design progress situation display program is carried out by OS by each workstation at the time of workstation starting, and it operates continuously till a halt of a workstation.

[0035] In drawing 9 , first, at step 900, it judges whether the design progress situation managed table 55 was updated, and if there is modification, if there is nothing, it will shift to step 901 to step 904. The first decision after program starting of step 900 is judged to be "those with updating." At step 901, the data of the design progress situation managed table 55 are incorporated. At step 902, the design progress situation display already displayed is eliminated. A design progress situation is expressed as step 903 on a screen using the data of step 901. At step 904, if whether the carbon button of a mouse was pushed judges, it is pushed all over the design progress situation display screen and it is not pushed on step 905, it returns to step 900 again. At step 905, it judges whether the copy command in a menu was directed from the input coordinate value of a mouse, and if it is copy command directions, and there is nothing, it will progress to step 909 to step 906. At step 906, it judges whether the graphic form of a design data was directed with the mouse, if it is directions of a design data, it will progress to step 907, otherwise, it returns to step 900. At step 907, highlighting of the graphic form of the design data which set information to ejection and the table for copy, and was directed by step 908 in the directed design data name is carried out. At step 909, all the design datas currently recorded on the table for copy are cop (ied) on a self-workstation from a database. When the design data which cop(ies) at this time is already editing by other workstations, warning of editing into a bottom of screen is displayed. At step 910, highlighting of the design data which copy from a database ended is usually returned to a display, and it returns to step 900.

[0036] Drawing 10 is that of the processing flow chart of step 903 of drawing 9 .

[0037] First, design data-hierarchy structure data are incorporated from the design database 11 of the administrative workstation 10, the display position of each indicative data in a design progress situation display screen (drawing 6) is computed, and the polygonal line 62 showing the hierarchical relationship between each data is expressed as step 1001. At step 1002, one design progress situation data is incorporated from the design progress situation managed table 55. At step 1003, according to the process of the incorporated design progress situation data, if it is functional description and is logic description in step 1004, if it is a circuit description, it will shift to step 1005 to step 1006. At step 1004, by the design progress status code, if codes are 2 and 4, and codes are 0, 1, and 3, it will progress to step 1007 to step 1008. At step 1007, the graphic form and data name showing a functional description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a functional description process with step 1008 like step 1007, applying hatching, a data name is displayed and it shifts to step 1013.

[0038] When a process is logic description at step 1003, if codes are 2 and 4, and codes are 0, 1, and 3, at step 1005, it will progress to step 1009 by the design progress status code to step 1010. At step 1009,

the graphic form and data name showing a logic description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a logic description process with step 1010 like step 1009, applying hatching, a data name is displayed, and it shifts to step 1013.

[0039] When a process is a circuit description at step 1003, if codes are 2 and 4, and codes are 0, 1, and 3, at step 1006, it will progress to step 1011 by the design progress status code to step 1012. At step 1011, the graphic form and data name showing a circuit description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a circuit description process with step 1012 like step 1011, applying hatching, a data name is displayed, and it shifts to step 1013.

[0040] The graphic form which judges whether there is WS currently used for edit of a design data, and expresses Activity WS with step 1013 by step 1014 if it is, and an activity WS name are displayed based on the display position computed at step 1001, and it progresses to step 1015. If there is no activity WS, it will shift to step 1015 promptly. At step 1015, it judges whether all the data of the design progress situation managed table 55 were processed, and if it is not processing termination, if it is return and termination, processing will be ended to step 1002.

[0041] In the above-mentioned example, although the design progress situation managed table 55 was given to the administrative workstation 10, the same design progress situation managed table as all workstations can also be given and managed.

[0042] Moreover, although it was shown that it is in the middle of a design by carrying out hatching of the graphic form which expresses the data to the data in the middle of a design, as shown in this drawing (c), it may be made for a graphic form configuration to be replaced with like drawing 12 (a), or to change some bows of a graphic form, as shown in this drawing (b), or to perform hatching to some graphic forms. Or the foreground color of a graphic form is also changeable. Furthermore, it is also possible to control extent of the field which inputs the completeness of a design from an architect for the numeric value of percent, displays the percent value 120 as shown in this drawing (d), or performs extent of change of the graphic form configuration of this drawing (a), extent of line-type modification of some graphic forms of this drawing (b), or hatching of this drawing (c) according to the percent value of the completeness of a design.

[0043]

[Effect of the Invention] Which design data is in what kind of design progress situation can take control easily, without according to this invention, asking a database, since the current progress situation of a design data is displayed as a graphic form. Moreover, since the actuation for an activity in the simulation of a design data can carry out using the display of a design progress situation, it can lessen a directions error.

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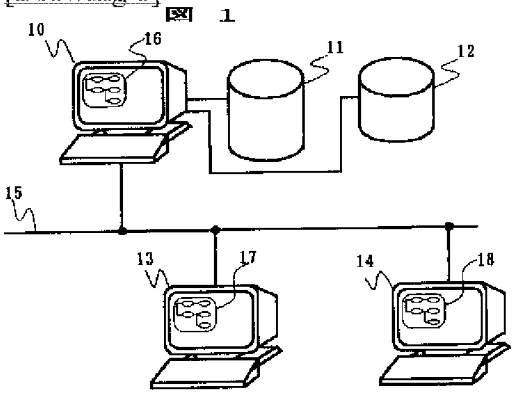
DRAWINGS

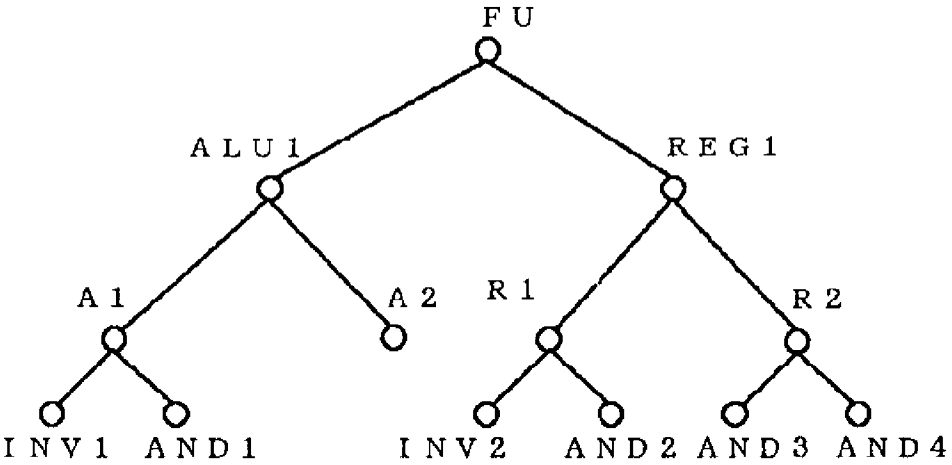
[Drawing 1]

図 1



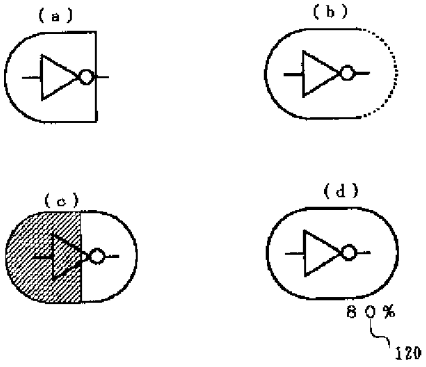
[Drawing 2]

図 2



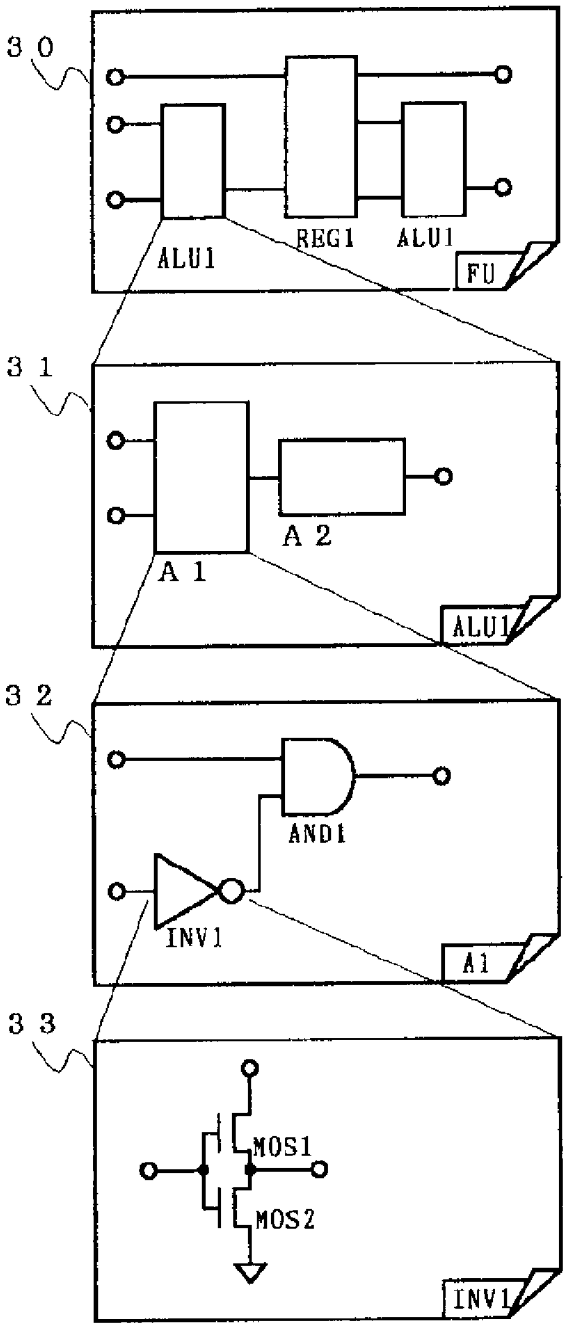
[Drawing 12]

図 1 2



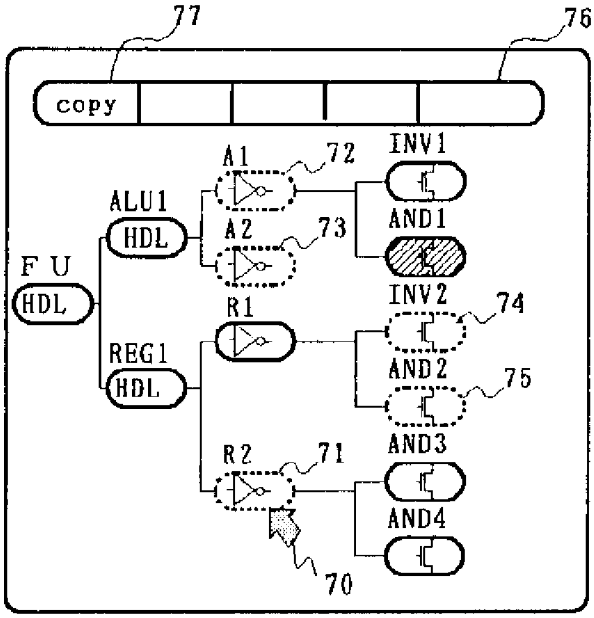
[Drawing 3]

図 3


3 0
ALU1
REG1
ALU1
FU
3 1
A 2
A 1
ALU1
3 2
AND1
INV1
A1
3 3
MOS1
MOS2
INV1

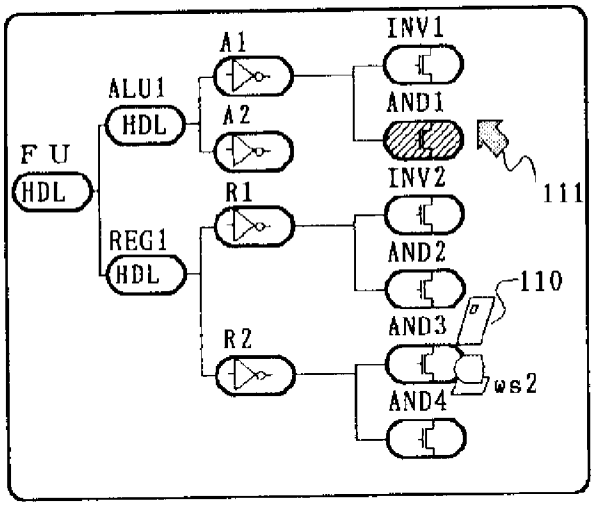
[Drawing 7]

図 7



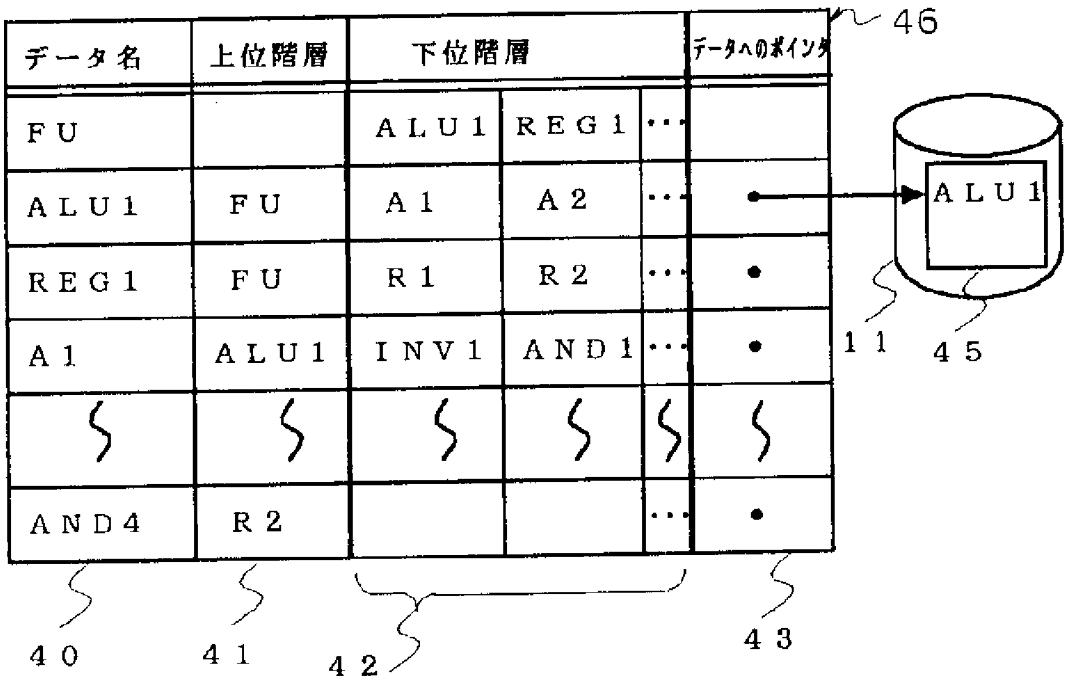
[Drawing 11]

図 1 1



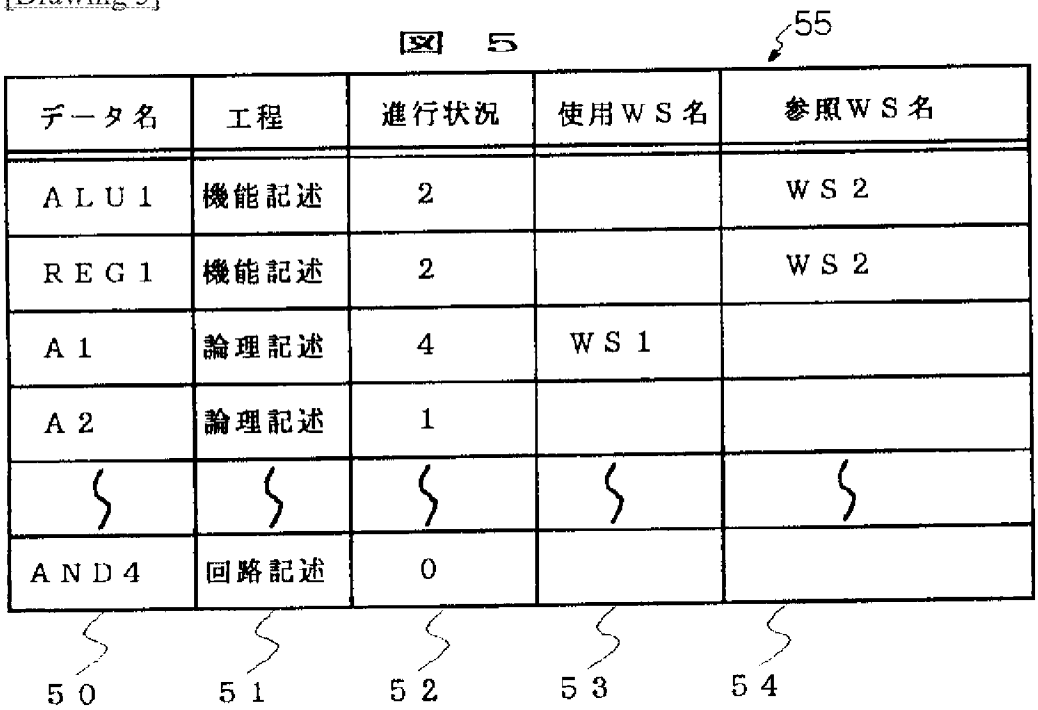
[Drawing 4]

図 4



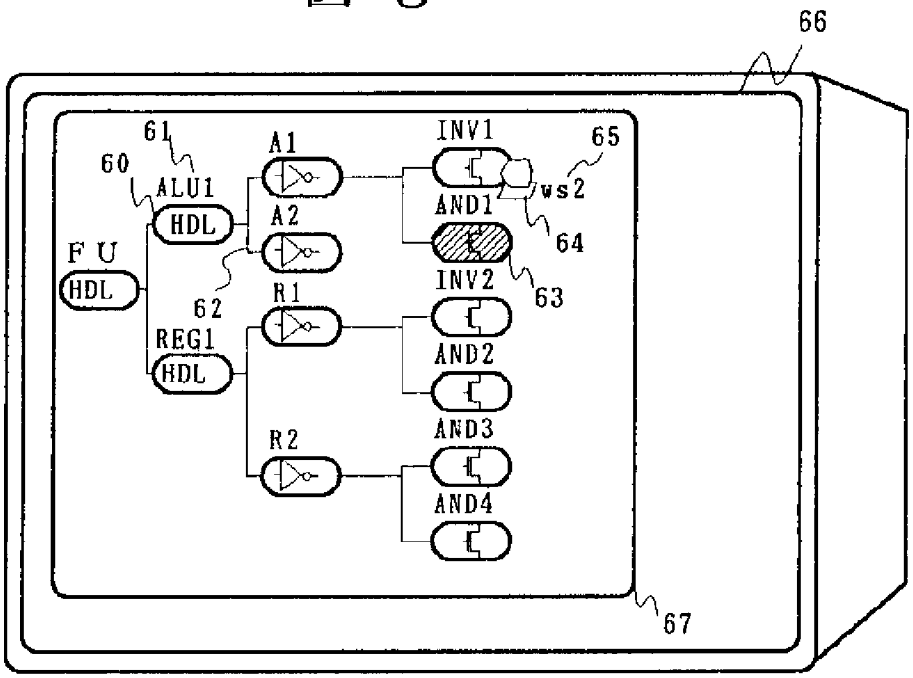
[Drawing 5]

図 5



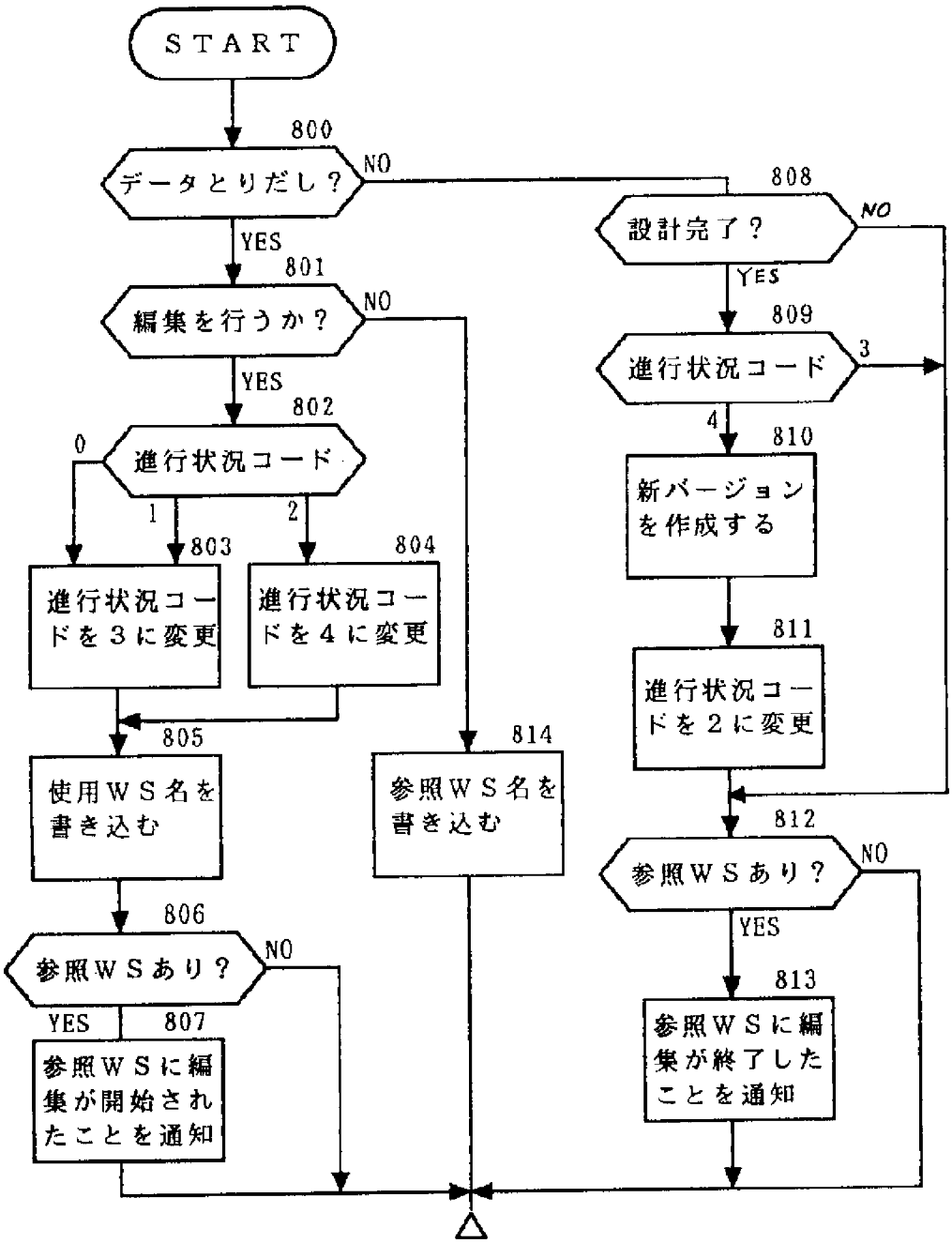
[Drawing 6]

図 6


66
61
60
ALU1
HDL
A1
A2
INV1
65
ws2
AND1
64
F U
HDL
62
R1
INV2
63
REG1
HDL
AND2
R2
AND3
AND4
67

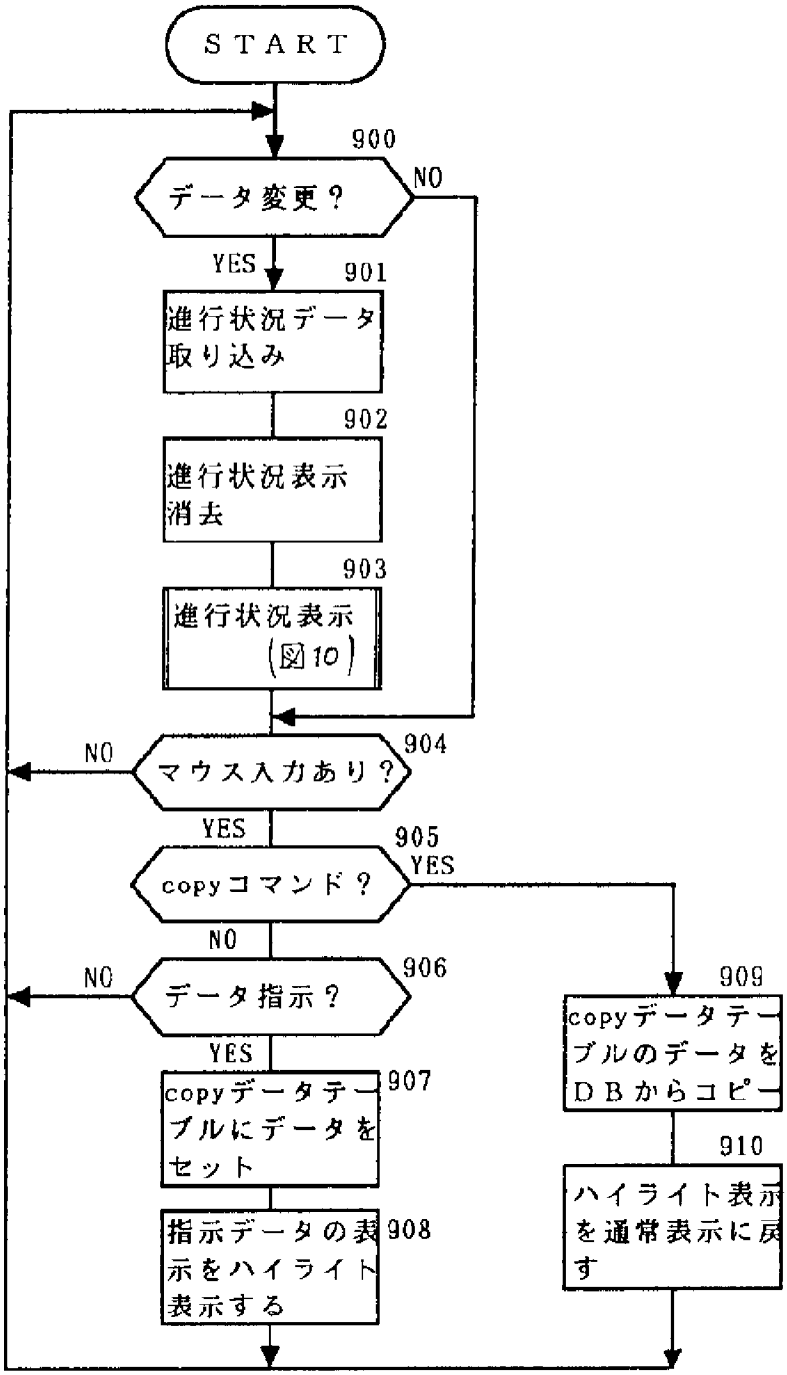
[Drawing 8]

図 8


START
800
データとりだし？
NO
YES
801
編集を行うか？
NO
YES
802
進行状況コード
0
1
2
803
進行状況コードを３に変更
804
進行状況コードを４に変更
805
使用ＷＳ名を書き込む
806
参照ＷＳあり？
NO
YES
807
参照ＷＳに編集が開始されたことを通知
814
参照ＷＳ名を書き込む
808
設計完了？
NO
YES
809
進行状況コード
3
4
810
新バージョンを作成する
811
進行状況コードを２に変更
812
参照ＷＳあり？
NO
YES
813
参照ＷＳに編集が終了したことを通知

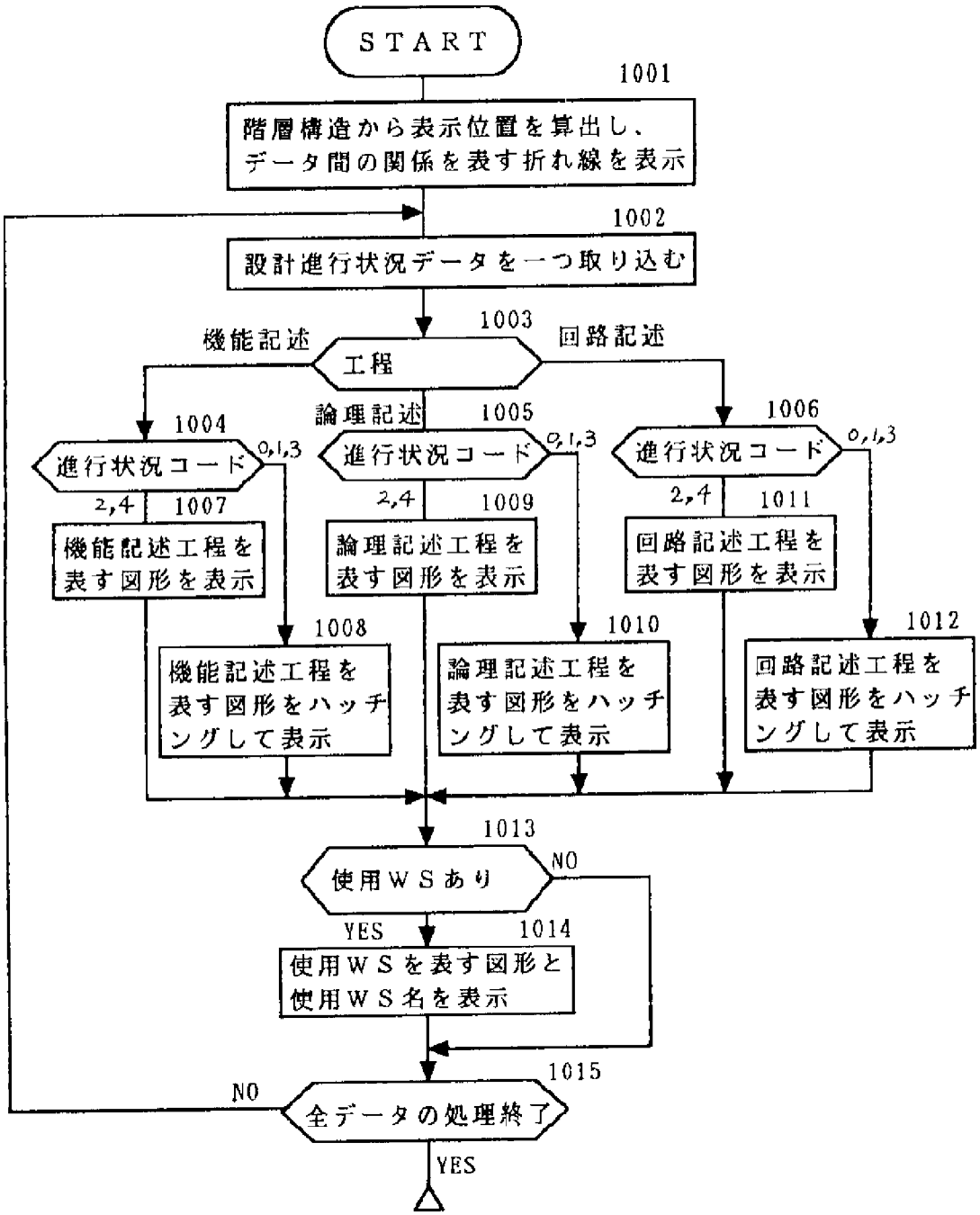
[Drawing 9]

図 9



[Drawing 10]

図 1 0



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EFFECT OF THE INVENTION

[Effect of the Invention] Which design data is in what kind of design progress situation can take control easily, without according to this invention, asking a database, since the current progress situation of a design data is displayed as a graphic form. Moreover, since the actuation for an activity in the simulation of a design data can carry out using the display of a design progress situation, it can lessen a directions error.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained according to a drawing.
[0017] Drawing 1 shows this example CAD structure of a system. In this drawing, 10 is an administrative workstation (WS) and a network where in a design database file and 12 a design progress situation managed table, and 13 and 14 connect with the workstation for a design, and 15 connects [11] each workstation mutually. Here, although two workstations 13 and 14 for a design are shown for convenience, three or more sets can also connect. Each of workstations 10, 13, and 14 performs CAD programs (for example, a logic diagram edit editor, a circuit diagram edit editor, etc.) on the workstation concerned. Storing management of the design datas, such as a logic diagram side created by each workstation, is carried out by administrative workstation 10 through a network 15 at the design database file 11 in that case. Of course, by workstation 10, you may be the system which only manages by not editing. Moreover, although it illustrated so that it might be stored in storage with separate design database file 11 and design progress situation managed table 12, you may make it stored in the same storage.
[0018] In this system, it makes it easy for each architect to hold the whole design progress situation by managing the design progress situation of each design data on the design progress situation managed table 12, and displaying the management data as design progress situations 16, 17, and 18 on the display screen of workstations 10, 13, and 14.
[0019] Drawing 2 shows the example of the design data-hierarchy structure designed by this CAD system.
[0020] This drawing expresses the layered structure of a real number arithmetic unit called FU, and supports the example of each hierarchy drawing of drawing 3 mentioned above. An arithmetic unit FU consists of a drawing ALU 1 described on functional description level, and a drawing REG 1 so that drawing 2 may show. ALU1 consists of the drawings A1 and drawings A2 which were described on logic description level. REG1 consists of a drawing R1 of logic description level, and a drawing R2 similarly. Furthermore, A1 consists of the drawings INV1 and Drawings AND 1 by which circuit description level description was carried out. Similarly, R1 consists of the drawings INV2 and Drawings AND 2 of circuit description level, and R2 consists of the drawings AND 3 and Drawings AND 4 of circuit description level.
[0021] The design data of each of these components is managed as a design database 11 on the managed table 46 as shown in drawing 4 . Management of the design data which includes data-hierarchy relation in the managed table 46 corresponding to each design data with the pointer 41 to high order hierarchy data, the pointer 42 to a low order hierarchy, and the pointer 43 to a design data is performed. The pointer 43 to a design data accesses a design data by pointing at design-data ALU45 in the design database file 11.
[0022] In this system, the progress situation of a design data is managed on the design progress situation managed table 55 (it corresponds to 12 of drawing 1) further shown in drawing 5 .
[0023] The design data name 50, a design process 51, the design progress situation 52, the activity WS name 53, and the reference WS name 54 are recorded on the design progress situation managed table 55

for every design data. Whenever it outputs and inputs data to a design database 11 by administrative workstation 10, these data are created / updated when a database manager starts a design progress situation manager.
[0024] The design process 51 of drawing 5 showed in which hierarchy level a design data would be, and has specified hierarchy level by description classification here. The design progress situation 52 expresses with a code whether a design data is in what kind of design progress situation, and is managed.
[0025] The code of the design progress situation 52 expresses five steps of progress situations with this example from '0' to '4'. It is shown that the code '0' has not created data and a code '1' shows that data are in the middle of creation. Moreover, it is shown that data have completed the code '2' and a code '3' shows what is current been under edit by the data in the middle of creation (it opens for someone's edit). Furthermore, what is been under edit now by the data which the code '4' has completed (someone opens for modification or version up) is shown. In case the information on whether the design was completed or not is stored in a design database 11 after editing a design data by the CAD program on each workstation, according to a database manager, an architect inputs it as management information.
[0026] The activity WS name 53 records WS name which is using data now for edit, and WS name to which the reference WS name 54 is referring to data now for simulation is recorded. For example, the data of A2 of drawing 5 turn out that a configuration is data in the middle of creation of the process of logic description since the code of 'logic description' and the progress situation 52 is '1'. Here, supposing it begins the editing task of data of WS three A2, the code of a design progress situation will be rewritten from '1' to '3', and WS3 will be written in an activity WS name. Thus, the progress situation of each current design data is reflected in the design progress situation managed table 55.
[0027] Drawing 8 is a flow chart which shows the flow of processing of a design progress situation manager. First, I/O of a design data is judged at step 800, and if it is an input to a database, it will shift to step 808, otherwise, step 801. At step 801, it judges whether it is the data ejection for edit, if it is the data ejection for edit, it will shift to step 802, and if it is the data ejection for reference, a reference workstation name will be written in the design progress situation managed table 55 by step 814, and processing will be ended. At step 802, a current design progress status code is judged, if codes are '0' and '1', a design progress status code will be changed into '3' at step 803, and if it is '2', a design progress status code will be changed into '4' by step 804, and it will shift to step 805. At step 805, the workstation name used is written in the design progress situation managed table 55. At step 806, it notifies that judged whether a reference workstation would exist, and edit of reference data was started by the reference workstation by step 807 when it was, and if there is nothing, processing will be ended.
[0028] At step 808, judging from the directions data of the architect of being the completion of a design, if a design data is the completion of a design, if it is not completion, it will shift to step 809 to step 812. a design progress status code current at step 809 -- investigating -- a code -- '3' -- if it becomes -- step 811 -- shifting -- a code -- '4' -- if it becomes, a design data will be stored as data of a new version by step 810, and it will progress to step 811. A current design progress status code is changed into '2' at step 811. At step 812, it notifies that judged whether a reference workstation would exist, and edit of reference data was completed to the reference workstation by step 813 when it was, and if there is nothing, processing will be ended.
[0029] Drawing 6 shows the example of a graphic display of the design progress situation displayed by the design progress situation display program of each workstation on Screen 66 of each workstation using the data of the design progress situation managed table 55 (drawing 5).
[0030] In drawing 6 , the graphic form 60 which expresses a data name 61 and a process in the design progress situation display window 67 expresses one design data, and the polygonal line 62 showing hierarchical relationship shows the relation between each data. Here, the graphic form showing a process is displayed on it, applying hatching 63 in the case of the data in the middle of a design. Moreover, the graphic form 64 and the workstation name 65 which show that edit is performed are displayed on the data to which edit is performed by other workstations. Whenever this design progress situation display changes a design progress situation, it is updated by the design progress situation display program, and

the newest design progress situation is always displayed.
[0031] In addition, when there is advice from other workstations, you may make it display the graphic form 110 in which it is shown that there was advice along with the workstation which emitted advice, as shown in drawing 11 . In the cursor 111 directed with a mouse etc., in piles, by pressing a mouse button, a new window is opened by the graphic form 110 and the content of advice can be displayed on it in the window.
[0032] Drawing 7 shows the example of a display at the time of directing of which hierarchy data are used as a design data for simulation.
[0033] Data are directed by laying on top of the graphic form 71 showing the process of a design data which needs first the cursor 70 operated with pointing input devices, such as a mouse, at the time of the design-data activity for simulation, and pressing a mouse button. The directed data show that highlighting of the graphic form of the data was carried out, and it was directed. In drawing 7 , the dotted line is expressing highlighting. When the displayed data are editing at this time, a warning message is displayed on a bottom of screen. Next, each design data to data 71, 72, 73, 74, and 75 which directed cursor to the data copy command 76 of a command menu 77 from the top FU by pressing a mouse button in piles by carrying out by repeating the above-mentioned actuation to the data to need is COPY(ed) in a self-workstation, and becomes usable because of simulation from a design database 11.
[0034] Drawing 9 is a flow chart which shows the flow of processing of a design progress situation display program in which it operates by each workstation. Auto-boot of this design progress situation display program is carried out by OS by each workstation at the time of workstation starting, and it operates continuously till a halt of a workstation.
[0035] In drawing 9 , first, at step 900, it judges whether the design progress situation managed table 55 was updated, and if there is modification, if there is nothing, it will shift to step 901 to step 904. The first decision after program starting of step 900 is judged to be "those with updating." At step 901, the data of the design progress situation managed table 55 are incorporated. At step 902, the design progress situation display already displayed is eliminated. A design progress situation is expressed as step 903 on a screen using the data of step 901. At step 904, if whether the carbon button of a mouse was pushed judges, it is pushed all over the design progress situation display screen and it is not pushed on step 905, it returns to step 900 again. At step 905, it judges whether the copy command in a menu was directed from the input coordinate value of a mouse, and if it is copy command directions, and there is nothing, it will progress to step 909 to step 906. At step 906, it judges whether the graphic form of a design data was directed with the mouse, if it is directions of a design data, it will progress to step 907, otherwise, it returns to step 900. At step 907, highlighting of the graphic form of the design data which set information to ejection and the table for copy, and was directed by step 908 in the directed design data name is carried out. At step 909, all the design datas currently recorded on the table for copy are cop (ied) on a self-workstation from a database. When the design data which cop(ies) at this time is already editing by other workstations, warning of editing into a bottom of screen is displayed. At step 910, highlighting of the design data which copy from a database ended is usually returned to a display, and it returns to step 900.
[0036] Drawing 10 is that of the processing flow chart of step 903 of drawing 9 .
[0037] First, design data-hierarchy structure data are incorporated from the design database 11 of the administrative workstation 10, the display position of each indicative data in a design progress situation display screen (drawing 6) is computed, and the polygonal line 62 showing the hierarchical relationship between each data is expressed as step 1001. At step 1002, one design progress situation data is incorporated from the design progress situation managed table 55. At step 1003, according to the process of the incorporated design progress situation data, if it is functional description and is logic description in step 1004, if it is a circuit description, it will shift to step 1005 to step 1006. At step 1004, by the design progress status code, if codes are 2 and 4, and codes are 0, 1, and 3, it will progress to step 1007 to step 1008. At step 1007, the graphic form and data name showing a functional description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a functional description process with step 1008 like step

1007, applying hatching, a data name is displayed and it shifts to step 1013.
[0038] When a process is logic description at step 1003, if codes are 2 and 4, and codes are 0, 1, and 3, at step 1005, it will progress to step 1009 by the design progress status code to step 1010. At step 1009, the graphic form and data name showing a logic description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a logic description process with step 1010 like step 1009, applying hatching, a data name is displayed, and it shifts to step 1013.
[0039] When a process is a circuit description at step 1003, if codes are 2 and 4, and codes are 0, 1, and 3, at step 1006, it will progress to step 1011 by the design progress status code to step 1012. At step 1011, the graphic form and data name showing a circuit description process are displayed on the display position computed at step 1001, and it shifts to step 1013. While displaying the graphic form which expresses a circuit description process with step 1012 like step 1011, applying hatching, a data name is displayed, and it shifts to step 1013.
[0040] The graphic form which judges whether there is WS currently used for edit of a design data, and expresses Activity WS with step 1013 by step 1014 if it is, and an activity WS name are displayed based on the display position computed at step 1001, and it progresses to step 1015. If there is no activity WS, it will shift to step 1015 promptly. At step 1015, it judges whether all the data of the design progress situation managed table 55 were processed, and if it is not processing termination, if it is return and termination, processing will be ended to step 1002.
[0041] In the above-mentioned example, although the design progress situation managed table 55 was given to the administrative workstation 10, the same design progress situation managed table as all workstations can also be given and managed.
[0042] Moreover, although it was shown that it is in the middle of a design by carrying out hatching of the graphic form which expresses the data to the data in the middle of a design, as shown in this drawing (c), it may be made for a graphic form configuration to be replaced with like drawing 12 (a), or to change some bows of a graphic form, as shown in this drawing (b), or to perform hatching to some graphic forms. Or the foreground color of a graphic form is also changeable. Furthermore, it is also possible to control extent of the field which inputs the completeness of a design from an architect for the numeric value of percent, displays the percent value 120 as shown in this drawing (d), or performs extent of change of the graphic form configuration of this drawing (a), extent of line-type modification of some graphic forms of this drawing (b), or hatching of this drawing (c) according to the percent value of the completeness of a design.

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned object, the distributed design exchange approach by this invention divides the object for a design into two or more hierarchies, the design progress situation of each component manages in the distributed design exchange approach that two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network, and it makes display on the display screen of the terminal unit with which each architect is using the design progress situation.
[0010] Preferably, it is a different graphic form for every process classification of the component, and said each component is displayed hierarchical. A design displays the graphic form of an incomplete component in distinction from the graphic form of the component which the design has completed in that case. Moreover, the graphic form of the component which is [current] under edit is accompanied, and the graphic form in which existence of the terminal unit under current edit is shown is displayed.
[0011] Moreover, it enables it to order the design data of the component through said network by directing the component displayed on said display screen.
[0012] In the distributed computer-aided design to which the distributed computer-aided design by this invention divides the object for a design into two or more hierarchies, and two or more architects design each component of a hierarchy in parallel using the terminal unit mutually connected by the network At least one Administrative Station which manages the design progress situation of each of said component by two or more architects while managing the design database which stores a design data, It has two or more terminal units for a design which two or more architects use for a design. Said Administrative Station The engineering-data-management table which manages the hierarchy connection relation of each of said component, and the response relation between the design data in said design database, and each component, The progress situation managed table which manages the design progress situation of the design data of each component, It has a means to update said progress situation managed table in the case of transfer of the design data between said terminal units for a design. Said terminal unit for a design It is characterized by having a means to display the design progress situation of each of said component on a display screen according to the content of said progress situation managed table, and a means to input setting out and update information of the content of said progress situation managed table.
[0013] Preferably, said progress situation managed table holds the process classification and a progress status code for said every component.
[0014] Moreover, said progress situation managed table holds further either [at least] a terminal unit name while editing the design data of the component concerned for said every component, or a terminal unit name while referring to the design data of the component concerned.

[Translation done.]

* NOTICES *

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OPERATION

[Function] The design progress situation of each design data can be held easily, without asking a database, since the progress situation of each design data which each architect is designing is displayed on the display screen of the terminal unit which each architect is using. Moreover, since the design data of the progress situation can be ordered and used by directing the progress situation of each displayed design data, the design data to need is obtained easily. Furthermore, since the actuation for an activity in the simulation of a design data can carry out using the display of a design progress situation, it can lessen a directions error.

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PRIOR ART

[Description of the Prior Art] In the design of VLSI, since the circuit magnitude is as large as millions transistors, the hierarchical design is performed. Therefore, also in the CAD system which supports those designs, design data-hierarchy management and common management of the design data by two or more architects are performed.
[0003] For example, managing the relation between drawings, or adding the fix information text which shows a correction good improper flag, a correction person name, a modification time, and a correction finish time to a design data like the publication to JP,2-48774,A, and two or more architects overlapping the same design data, and making it not correct is performed like a publication in a publication-number - 310473 [No.] official report by including the parentage between each drawing in the directory information of drawing data.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the means of displaying for management of the drawing information at the time of two or more architects doing the distributed concurrent design of a VLSI logic diagram, a circuit diagram, and the mask pattern by the dialogue with a computer, and management.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In an above-mentioned management method, although an architect can know what kind of layered structure an engineering-drawing side has, the input for retrieval is needed. For example, what kind of thing the drawing of the low order hierarchy of a certain drawing A has needs to make a CAD system search by using the drawing name A as a key. Moreover, since, as for whether it is under [edit] ********, the CAD program has managed the drawing with other architects, it does not understand until it is going to use the drawing by the CAD system. Furthermore, the architect was performing management about whether the engineering-drawing side is carrying out the completion of a design thoroughly. For this reason, when simulation is performed combining other architects' design data, the architect had to manage combining the data of which version of which level of hierarchy data it would use, management is complicated and a mistake tended to happen.
[0005] For example, in simulation, simulation is performed to a design data with a hierarchy as shows drawing 3 using the hierarchy level to need. In drawing 3 , a drawing 30 is the top drawing of an arithmetic unit FU, and components ALU1 and REG1 are described by functional description. A drawing 31 is a drawing of the low order hierarchy of the component ALU 1 of a drawing 30, and components A1 and A2 are described by functional description. A drawing 32 is the logic diagram of the low order hierarchy drawing of the component A1 of a drawing 31, and is constituted by the logic symbol of AND1 and INV1. A drawing 33 is the circuit diagram of the low order hierarchy drawing of INV1 of a drawing 32, and consists of MOS transistors MOS1 and MOS2. Although omitted in drawing 3 , it has the same layered structure as a component ALU 1 also about the component REG 1, and has a layered structure as specifically shown in drawing 2 .
[0006] Here, when performing a simulation about the arithmetic unit FU of a drawing 30, about a component ALU 1, the component A2 of a drawing 31 is used as functional description, using functional description about the component REG 1 of a drawing 30. About the component A1 of a drawing 31, further, it is the thing using INV1 as circuit level of a low order hierarchy's drawing 33 further, and AND1 of a low order hierarchy's drawing 32 is replaced with what was used as logical level. Thus, performing simulation using an available low order hierarchy's drawing part is performed. If using the drawing of the hierarchy who changes with each data performs simulation on detailed level like circuit level, it will be because it says [that computation time's starting for a long time and two or more architects' design progress are not uniform although the precision of simulation improves, and all a certain hierarchy's design datas have not necessarily gathered], and will be because it is going to adopt the most effective simulation level about each data.
[0007] however, the design data of the level which can be used for simulation is which conventionally -- since the architect needed to perform that management -- directions of data -- a mistake -- easy -- there was a problem that the response to the newest design condition was overdue.
[0008] The object of this invention makes easy control of the progress situation of the design at the time of a distributed design, and is to offer the distributed design exchange approach and system which can acquire immediately the information which each architect needs easily.

[Translation done.]